CARBONATE AQUIFER POLLUTION ORIGINATING FROM MULTIPLE SOURCES NEAR WOODSTOCK ONTARIO

April, 1977

Ministry of the Environment
Ontario

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SOUTHWESTERN REGION
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by

Blagoje Novakovic

April, 1977
LONDON

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF PHOTOGRAPHS

I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I -
I took the one less travelled by,
And that made all the difference.

Robert Frost (1875-1963)

SUMMARY

Investigation by staff of the Ministry of the Environment into complaints of contamination of domestic water supplies has identified the Denby landfill site as a major source of groundwater quality degradation. The landfill is located in a worked-out gravel pit, upslope of strip development along highway 2, west of the City of Woodstock, Ontario. Domestic and commercial solid wastes have been disposed of at this landfill for the past 20 years.

Domestic water supplies in the vicinity of the landfill are obtained from the upper portion of the bedrock consisting of a cherty, fractured limestone. The bedrock is overlain by silty tills and glaciofluvial sands and gravels of which the deposits forming the gravel pit are a part. In the area of domestic well development, the silty till deposits are discontinuous. Leachate from wastes placed in the landfill have moved through sand and gravel deposits into the fractured bedrock. Sampling has identified pollutants related to landfilling as well as contaminants from road salting and from individual subsurface waste disposal system.

Water quality impact from de-icing operations and from septic tanks effluent were noted in a 1972 Ministry's report and have likely been affecting local water supplies for some considerable period. The introduction of leachate from the Denby landfill, however is a relatively recent and highly visable occurrence causing unpleasant taste and odour as well as discolouration of well water supplies. While all three sources are responsible for identifiable pollutants in local water supplies, the landfill leachate must be regarded as the most critical input.

The landfill operation should be terminated as soon as possible, and properly covered to minimize leachate production. The means of restoring individual water supplies has yet to be worked out between staff of the Ministry of the Environment, the individuals concerned and officials of Oxford County.

CHAPTER 1

INTRODUCTION

1.1 Location

The Denby sanitary landfill site is located about 3700 feet (1128 m) southwest of the Woodstock city limits by road. It occupies the central portion of lot 1, Broken Front Concession, South-West Oxford Township, Oxford County. The area encompassed by this study is indicated in Figure 1.

The site is located in an abandoned sand and gravel pit and occupies approximately 4 acres (1.6 ha). The site is zoned M5 (Disposal Industrial Zone) for which the permitted use is a garbage dump or a disposal area in accordance with Bylaw 1158. This zoning was approved by the Ontario Municipal Board on August 21, 1967.

Access to the site is provided by a gravel road about 1100 feet (335 m) in length which connects to provincial highway 2 (Figure 1). The landfill is well isolated by natural topography and vegetation.

1.2 Present Operation of the Denby Landfill Site

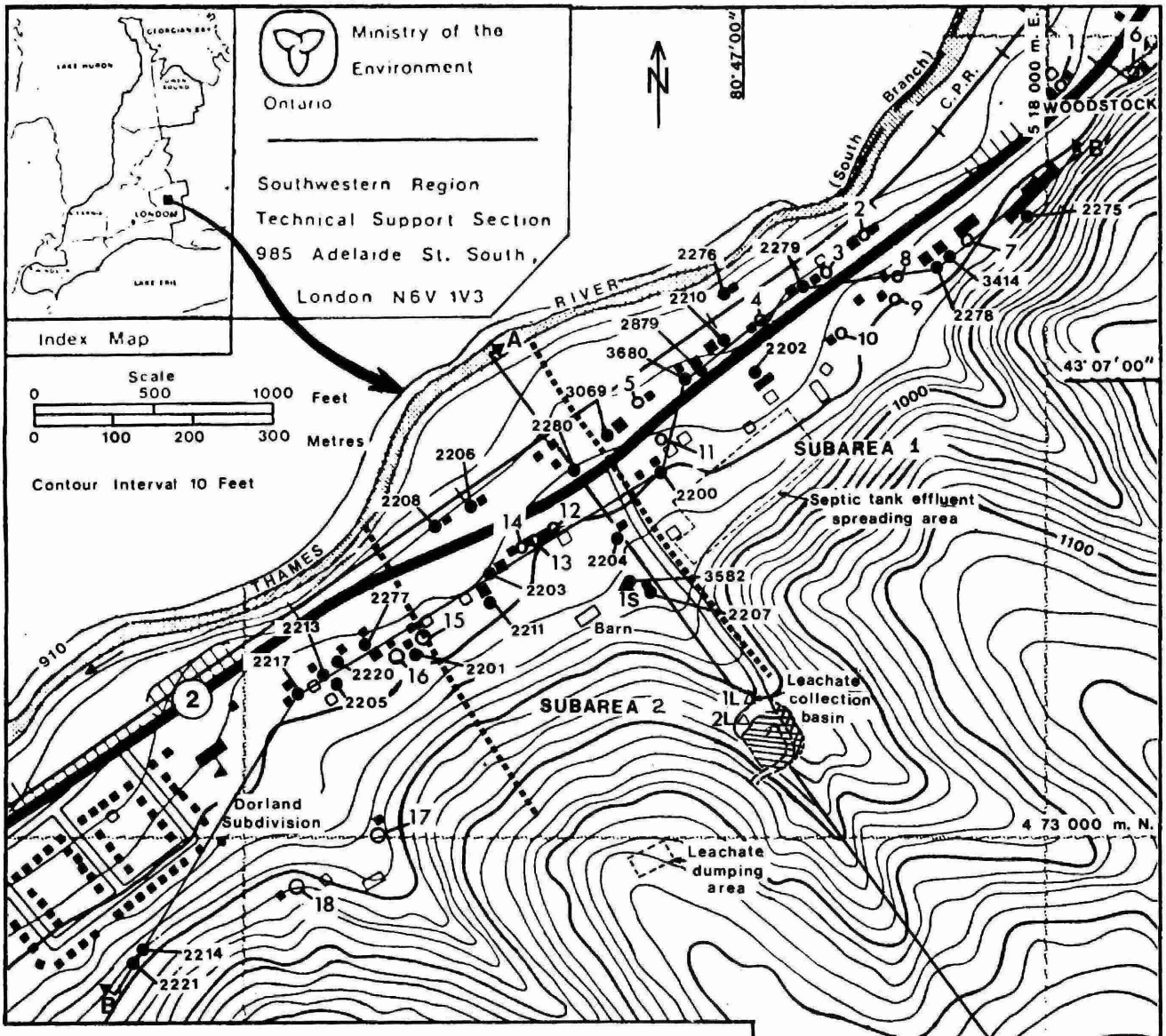
Presently, the Denby landfill site is operated by Denby and Sons Sanitation of R. R. # 1, Woodstock. Refuse is piled up and compacted in the northern portion of the site

(Photo 4). It is sometimes pushed northward taking advantage of the natural slope of the terrain. The refuse is periodically covered with sand, gravel and some silt which is obtained from an open face at the west margin of the site. A perforated drainage tile four inches in diameter is buried about 2 feet (0.6 m) deep at the northern margin of the landfill. The leachate collection system was installed last spring after problems were reported and was neither designed or approved by this Ministry. It collects a small amount of leachate and directs it into a concrete structure (septic tank) which is two-thirds buried at the northeastern corner of the site (Figure 1). When this tank is filled with leachate, the liquid is trucked to the wooded area southwest of the landfill site (Figure 1). However the tank sometimes overflows and the leachate moves overland for several tens of feet along a shallow depression where it quickly disappears into sand and gravel. This situation was observed during the site visit on September 30, 1976.

A solid waste survey carried out during the summer of 1976 indicated that domestic refuse taken to the site is collected from Beachville, Innerkip, Embro, Sweaburg, Folden Corners, small rurual areas around Woodstock and Ingersoll, from the Poole Company of Woodstock, and from Dominion Stores at Woodstock and Ingersoll.

1.3 Background

According to the present site operator, Mr. J. Denby (of Denby and Sons Sanitation, R. R. # 1 Woodstock) the site operation commenced some 20 to 25 years ago when the east portion of the present site was used (Figure 1).



LEGEND

- ●—2345* Bedrock well with M.O.E. well record number
- o— 9* Bedrock well; no well record on file with M.O.E.
- 1L△, 2L△; 1S▲ Leachate and soil sample locations with identification number
- A A' Cross-section location
- The Denby sanitary landfill site
  1 area presently being filled
  2 covered original site
- ..... Subarea boundary (approximately)

*All of these wells were sampled in 1976 except wells numbered 2204, 2205, 2207, and 2279; the locations of the first three wells have not been confirmed.

FIGURE 1. LOCATION MAP.

The earliest available information on this Ministry's file concerning the Denby sanitary landfill site dates from January, 1971. At that time, a site inspection report by an inspector of the Waste Management Branch of the former Ontario Department of Energy and Resources Management notes that site operation was unsatisfactory. This was reportedly because (a) the site was operated as an open dump and (b) the location was unacceptable. It was therefore recommended that site operation be improved by (a) the implementation of a rodent extermination programme and (b) the application of at least two feet (0.6 m) of cover material.

"Provisional Certificate of Approval for Waste Disposal Site" was first issued on June 25, 1971 to the late E. Denby (father of the present site operator). The Provisional Certificate was issued by the former Ontario Department of Energy and Resources Management and it expired after one year. The supporting information to the original application to operate this solid waste disposal site dated February 10, 1971 indicated that: (a) the site was about 10 acres in size, (b) location of the site was in a worked out portion of a sand and gravel pit the west side of which had a 40-foot (12 m) open face, (c) the refuse would be comprised of 75 percent domestic and 25 percent commercial wastes, (d) the total daily disposal would be four tons, (e) the site would serve about 3000 people and (f) the refuse would be disposed of in 4-foot (1.2 m) deep trenches with a maximum height of fill above ground surface of about 20 feet (6 m).

Periodic site inspections and reports subsequently revealed that the site was poorly operated; failure to cover and garbage burning were common practices. Provisional Certificates of Approval to operate this site continued to be issued on an annual basis to Denby and Sons Sanitation.

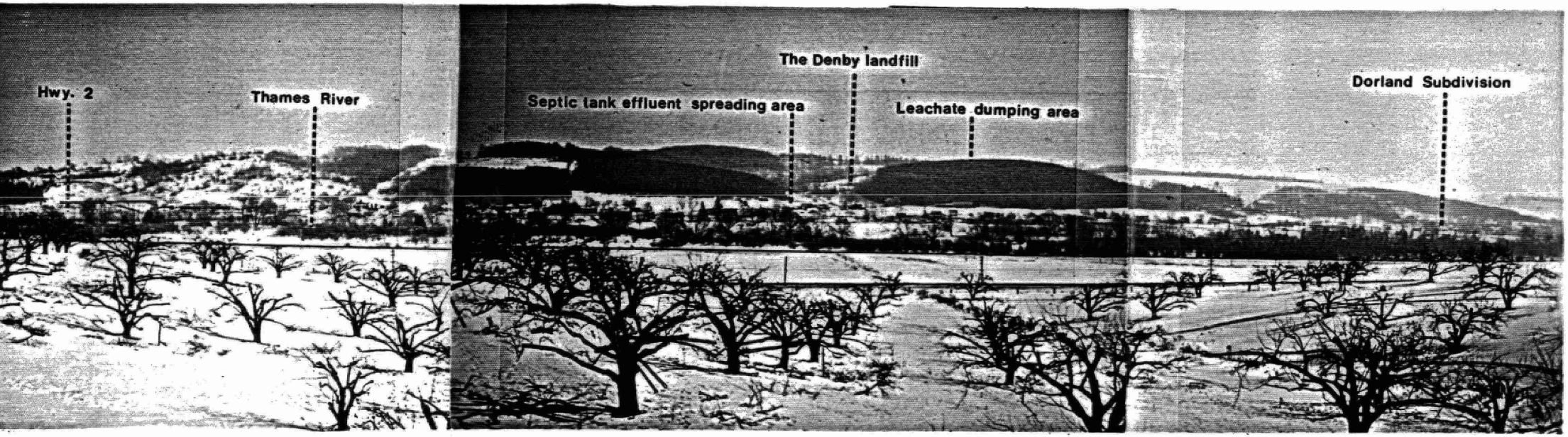


Photo 1. Looking southeast across the floodplain of Thames River, almost the entire study area is shown by this photograph.

1.4 Drainage and Topography

The Thames River and its associated meltwater channels are deeply incised into morainic terrain. The floodplain is relatively narrow and valley sides are quite steep. Erosional valleys have developed perpendicular to the Thames River (Photo 1). However, these are essentially dry and they are not developed in the floodplain areas due to the limited catchments and the permeable sand and gravel deposits which extend well up the valley sides.

The landfill is located in one such erosional valley about 115 feet (35 m) above river level. Drainage is toward the northwest, and the Thames River is the focus for surface and groundwater discharges. Maximum relief in the area is about 300 feet (91 m). The average topographic gradient is about 0.062 ft/ft.

1.5 Previous Investigation

A number of publications describing geologic aspects of the general area are available; a few of these are mentioned here but specific articles are detailed in the appropriate sections of the text.

Caley (1941) mapped the Paleozoic rocks underlying the Woodstock area. More recently, information obtained from wells drilled for oil and gas has led to some revision of Caley's contacts, particularly through the use of information outlining the topography of the bedrock surface beneath the glacial drift. Bedrock formations and their economic aspects are described in Hewitt (1960; 1964). Sanford (1969) also mapped Paleozoic rocks underlying the area.

Chapman and Putnam (1951) carried out small scale physiographic mapping and provided a synthesis of the deglaciation of southern Ontario. A comprehensive report and maps dealing with Pleistocene deposits and their economic aspects in the Woodstock area have been recently published (Cowan, 1975).

Wicklund and Richards (1961) published a map and report of the agricultural soils of Oxford County.

An interim report summarizing the investigation into gasoline contamination of private wells was published by the Ontario Ministry of the Environment (Pitts, 1972). This investigation was carried out in 1970 and included a small portion of the present study area.

1.6 Field Work

Field work with respect to this investigation commenced in April, 1976 after area residents approached this Ministry's Regional Office in London and complained that the quality of their domestic well water supplies had deteriorated. Field work consisted of collecting numerous water samples from domestic wells in the area, inspection of these wells, gathering information pertinent to well construction and examining the exact locations and positions of wells in relation to all the potential sources of contamination. It also included interviews of the local residents whose domestic wells are polluted and examination of the local geology and the landfill site operation.

Figure 1 shows locations of the sampled domestic wells. They are concentrated on both sides of provincial highway 2. Four digit well numbers indicate those wells

for which records are on file with the Ontario Ministry of the Environment (MOE). Wells numbered 1 to 18 inclusive are those for which there is no well record on MOE file, but for which chemical and bacteriological analyses are available.

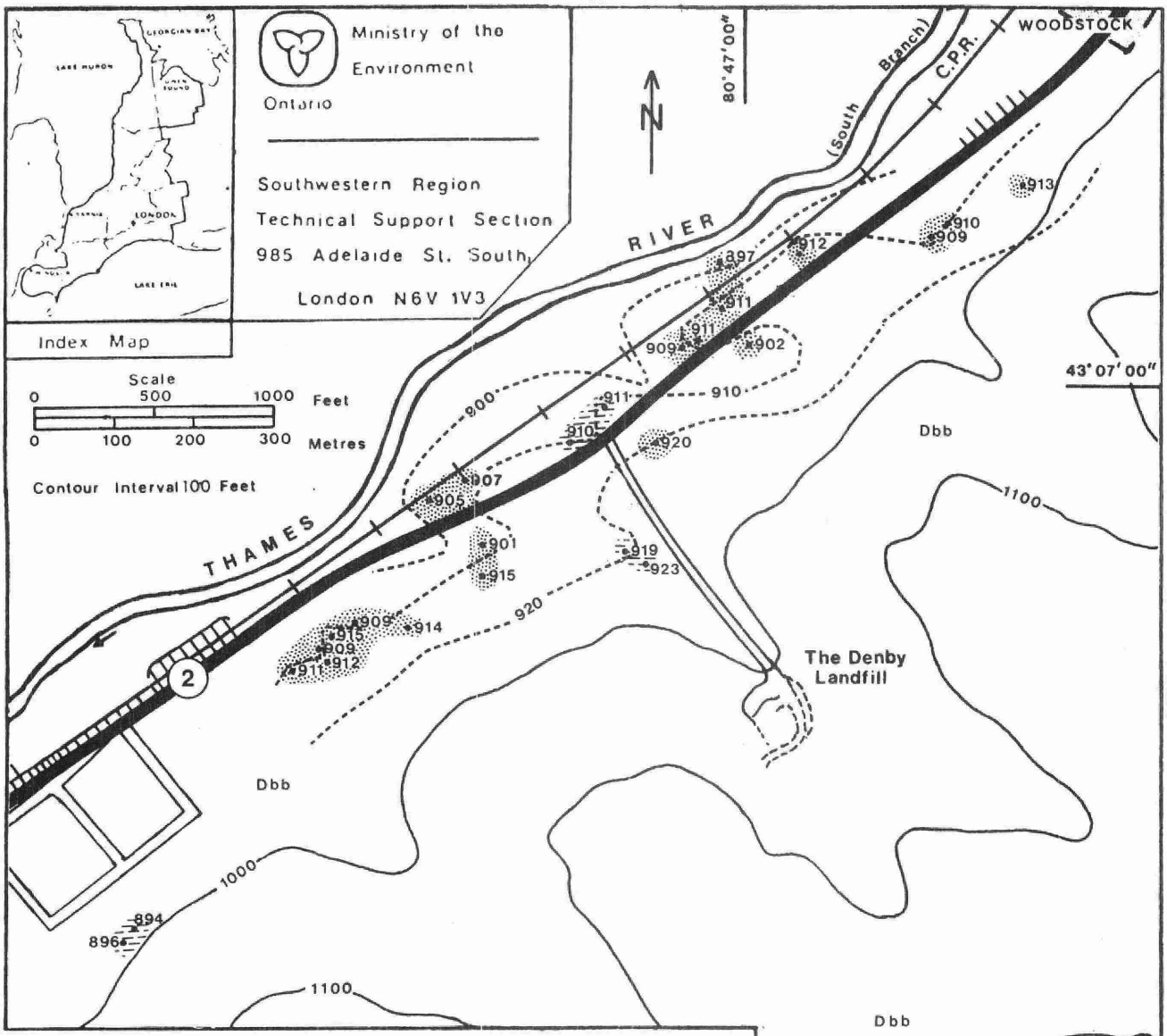
1.7 Geology

1.7.1 Bedrock Geology

Bedrock outcrops in the Thames River bed, but at the landfill site the bedrock is overlain by about 100 feet (30 m) of surficial deposits.

According to Hewitt (1960), the bedrock formation within the study area is of Middle Devonian Age and is part of the Bois Blanc Formation. However, according to Sanford (1969), the bedrock in the study area belongs to the Amherstburg Formation of the Detroit River Group. In this study the work of Hewitt has been adopted. According to Hewitt (1960), the Bois Blanc Formation is about 125 feet (38 m)thick at Ingersoll (about 12 miles (19.2 km) southwest from the study area) and thins in a southerly direction. It consists of medium brownish- grey, medium crystalline, medium to thin-bedded cherty and highly fractured limestone. These strata are reported to dip to the southwest at a rate of about 25 feet per mile (12 m per km).

In general, the bedrock surface in this part of the Province is south sloping and flat to gently rolling with few drainage indentations. However, in the study area



LEGEND

PALEOZOIC

MIDDLE DEVONIAN

Dbb — Bois Blanc Formation: medium-crystalline, highly fossiliferous, cherty limestone

SYMBOLS

Aquifer material resting on the bedrock

Aquitard material resting on the bedrock

•911 — Reference point with value of bedrock elevation above mean sea level (in feet)

910 — Bedrock surface contour in feet above mean sea level (interval 10 feet)

FIGURE 2. BEDROCK GEOLOGY AND BEDROCK SURFACE TOPOGRAPHY.

and its vicinity a local bedrock valley is present and coincides with the present position of the Thames River with an elevation just below 900 feet (279 m; Figure 2). Several hundred feet south of the study area a local dome-shaped bedrock structure occurs with an elevation a little over 1000 feet (305 m).

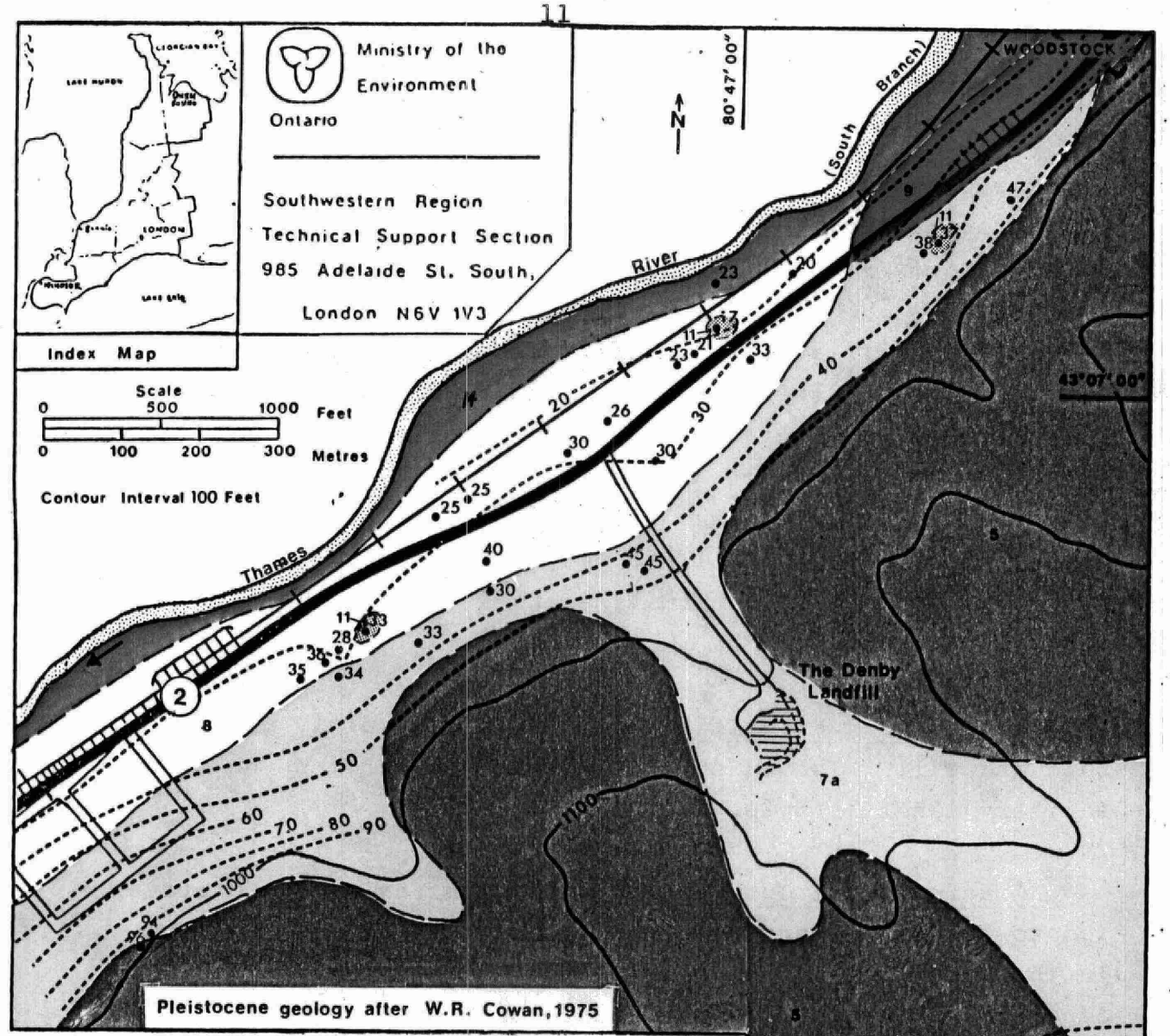
In the study area, the bedrock surface slopes northwest, towards the Thames River (South Branch). Where data are abundant, the minor irregularities of the bedrock surface become more apparent. Minor bedrock channels are associated with existing surface topographic "lows" which are perpendicular to the Thames River (Figure 2).

1.7.2 Surficial Deposits

Surficial deposits of Pleistocene age mantle the bedrock and form unconsolidated sediments in the area. The distribution of unconsolidated deposits is indicated in Figure 3.

The study area includes terrain referred to as the interlobate zone, i.e. an area located in the central part of the southern Ontario peninsula affected by glaciers flowing out of the Huron basin, the Erie-Ontario basin and perhaps Georgian Bay (Cowan 1975). The net result of lobes alternately invading the interlobate zone is an overall mixing of sediments originally having distinct source areas and lithologies and the production of lithologically similar tills.

Surficial deposits are of Late Wisconsinan age and consist of silt to sandy, silt tills, glaciofluvial gravels,



LEGEND

CENOZOIC
QUATERNARY
RECENT

14 Modern alluvium, unsubdivided: silt, sand, gravel.

PLEISTOCENE
LATE WISCONSINAN

11 Glaciolacustrine or pond deposits

9 Glaciofluvial outwash sand, unsubdivided.

8 Glaciofluvial outwash gravel and gravelly sand, some silt.

7a Ice-contact stratified drift, mainly gravel.

5 Zorra till: yellowish brown silt to sand silt till.

SYMBOLS

Geological boundary, position interpreted

30 Line of equal overburden thickness (isopach) in feet (interval 10 feet).

•33 Reference point with value of overburden thickness (in feet)

FIGURE 3. DISTRIBUTION AND THICKNESS OF SURFICIAL DEPOSITS.

sands with some silt, minor glaciolacustrine or pond deposits and modern alluvium. A description of surficial deposits identified in Figure 3 follows.

Zorra Till is a very stiff, commonly fissile, stony, silt or sandy, silt till, locally quite clayey near its base (Photo 2). It is usually leached of carbonates to a depth of about one foot and partially leached to a depth of 3.5 feet (1.5 m). Mean grain size falls within the coarse to fine silt range. The till is very poorly sorted. It occurs as ground moraine or in drumlins and is usually less than 20 feet (6 m) thick.

Ice-contact stratified drift consists mainly of gravel, sand and silt. These deposits directly underlies the Denby sanitary landfill site.

Glaciofluvial outwash deposits occur as sand and gravel (Photo 3) in the terrace along the major meltwater channel in the area (now occupied by Thames River). Gravel in these deposits varies from coarse cobble or boulder gravel, containing up to 20 percent sand, to fine pebble gravel and gravelly sand. Sorting is highly variable. Sands vary from very coarse to fine in mean grain size and are poorly sorted to well sorted (Cowan, 1975).

Glaciolacustrine or pond deposits are the results of deposition in small glacial lakes and the infilling of small postglacial ponds with slopewash or other locally derived materials. The delineation of these deposits in the study area is based on the information from water well records. These deposits are identified at three localities and confined within the small area (Figure 3) and consist of clayey silt. They may attain a thickness of up to 10 feet (3 m).

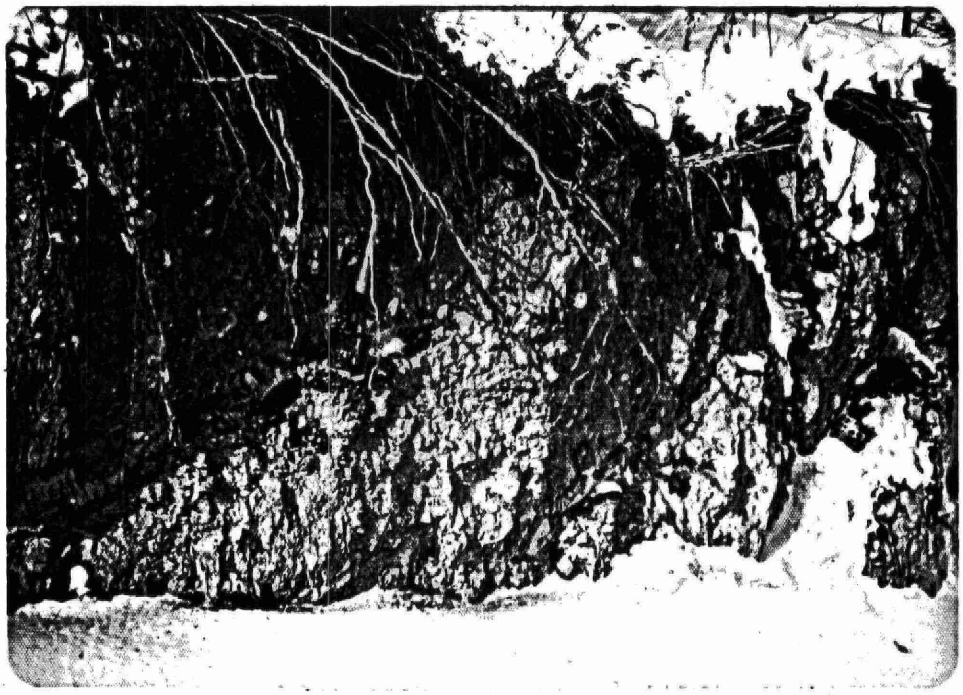


Photo 2. Zorra Till outcrops over considerable surface area and is classified as an aquitard - a part of till complex unit.

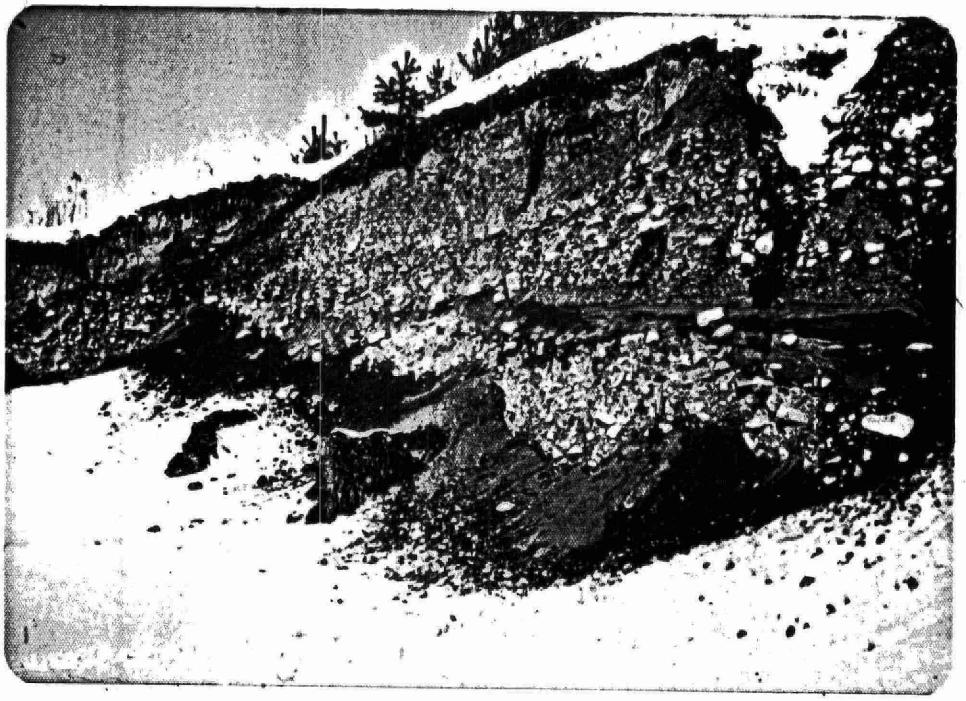


Photo 3. Glaciofluvial outwash deposits occur in the terrace along the Thames River. This is an aquifer material and forms the surface gravel and sand unit.

Modern alluvium consists of silt, sand, gravel and some clay and occurs along the floodplain of the Thames River. These sediments are locally derived and reflect the nature of the surrounding glacial sediments in composition. They are usually less than 10 feet (3 m) thick.

Throughout the study area, drift or overburden thickness varies from 0 to 300 feet (0 to 91 m; Figure 3). In the deeply incised Thames River Valley, drift generally ranges from 20 to 45 feet (6 to 74 m) in thickness; at the southeastern margin of the study area it reaches up to 300 feet (91 m) in thickness.

CHAPTER 2

HYDROGEOLOGY

2.1 Hydrostratigraphic Units

The cross sections shown in Figures 4 and 5 illustrate the distribution of hydrostratigraphic units in the broader area of the landfill site and along provincial highway 2. Existing lithologic units were grouped according to their common hydrogeologic characteristics to form three distinctive hydrostratigraphic units. The term hydrostratigraphic unit is defined as bodies of rock with considerable lateral extent with common hydrogeologic properties. It should be pointed out, that much of the following discussion is based on geological and hydrogeological information obtained from water well records as completed by independent drillers, and thus may be subject to some errors of interpretation. The following four hydrostratigraphic units underlie the area.

2.1.1 Bedrock Hydrostratigraphic Unit

A few feet, or a few tens of feet of the upper part of the bedrock are permeable and are considered to comprise a single hydrostratigraphic unit.

Bedrock is comprised of medium crystalline, thin-bedded cherty limestone. It is characterized by a fracture type of porosity irregularly distributed through the rock. The fractures in such type of rock are likely the result of ice stresses applied to the brittle rock.

Before the Pleistocene Epoch, the bedrock surface was exposed and subjected to extensive weathering. Atmospheric water containing carbon dioxide percolated through the original interstices, widening and deepening these joints and cracks by solution. During the Pleistocene Epoch the bedrock surface was overridden by successive ice sheets and was covered by glacial drift.

In carbonate rock of this sort several types of openings commonly contribute to permeability: (1) vertical joints in the ancient weathered zone within 10 to 20 feet (3 to 6 m) of the bedrock surface, (2) bedding joints within and below the ancient weathered zone, (3) primary intergranular permeability, perhaps enhanced by solution and (4) permeability of minor importance developed along leached gypsum stringers.

Of 47 wells in the area, 29 have water well records on file with this Ministry (Appendix A), and all of these reportedly obtain water from the bedrock. Information from the water well records indicates that that depth of well penetration into the bedrock varies from 3 to 45 feet (1 to 13.7 m; Figure 5). Furthermore, when hydraulic heads in these bedrock wells are contoured, the uniform pattern of piezometric lines suggests continuity between all points. Therefore, it is reasoned that the upper several tens of feet of the bedrock represents a continuous artesian aquifer system.

2.1.2 Till Complex Unit

This hydrostratigraphic unit includes all tills of the study area whether exposed or buried. The silt to sandy silt Zorra Till (Photo 2) outcrops over a considerable

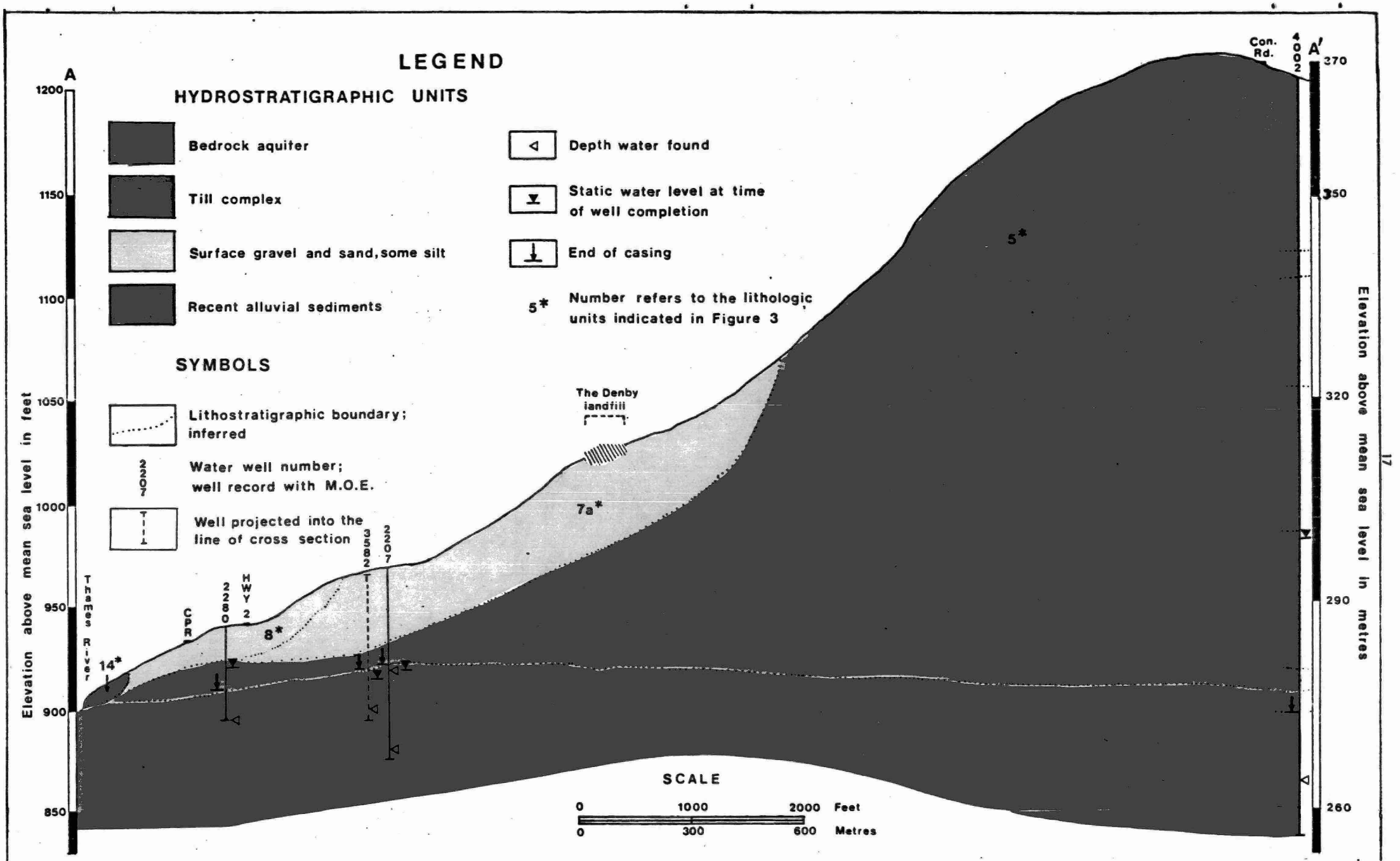


FIGURE 4 . VERTICAL SECTION A-A' SHOWING SEQUENCE AND DISTRIBUTION OF HYDROSTRATIGRAPHIC UNITS.

Section location is shown in Figure 1.

surface area. It is considered that the Zorra Till overlies clayey, silt Port Stanley Till. The stony, sandy, silt Catfish Creek Till may be buried over much of the area by both of the above tills. The textures of such silty and clayey tills causes them to have very low permeabilities and they are collectively classified as an aquitard. However, small lenses and beds of sand and gravel are present in these tills and may yield water sufficient for domestic needs. The thickness of this unit may reach up to 300 feet (91 m) (Figures 3 and 4).

2.1.3 Surface Gravel and Sand Unit

This unit includes ice-contact stratified deposits consisting mainly of gravel and glaciofluvial outwash gravel and gravelly sand (Photo 3), frequently overlain by several feet of sand and silt (Figures 4 and 5). In some places it contains a considerable amount of silt which reduces permeability. Drillers have reported the thickness of this unit up to 47 feet (14 m), but water has not been reported in any of the wells which had penetrated this granular material. This raises the question as to whether this highly permeable aquifer material is saturated or not. The likelihood is that it is unsaturated due to its hypsometric position. Because of the high permeability of this unit, it provides an excellent conduit for pollutants originating at the ground surface to reach the bedrock aquifer.

2.1.4 Glaciolacustrine Sediments

Confined within a small area at the ground surface these deposits are comprised of clayey silt and may reach up

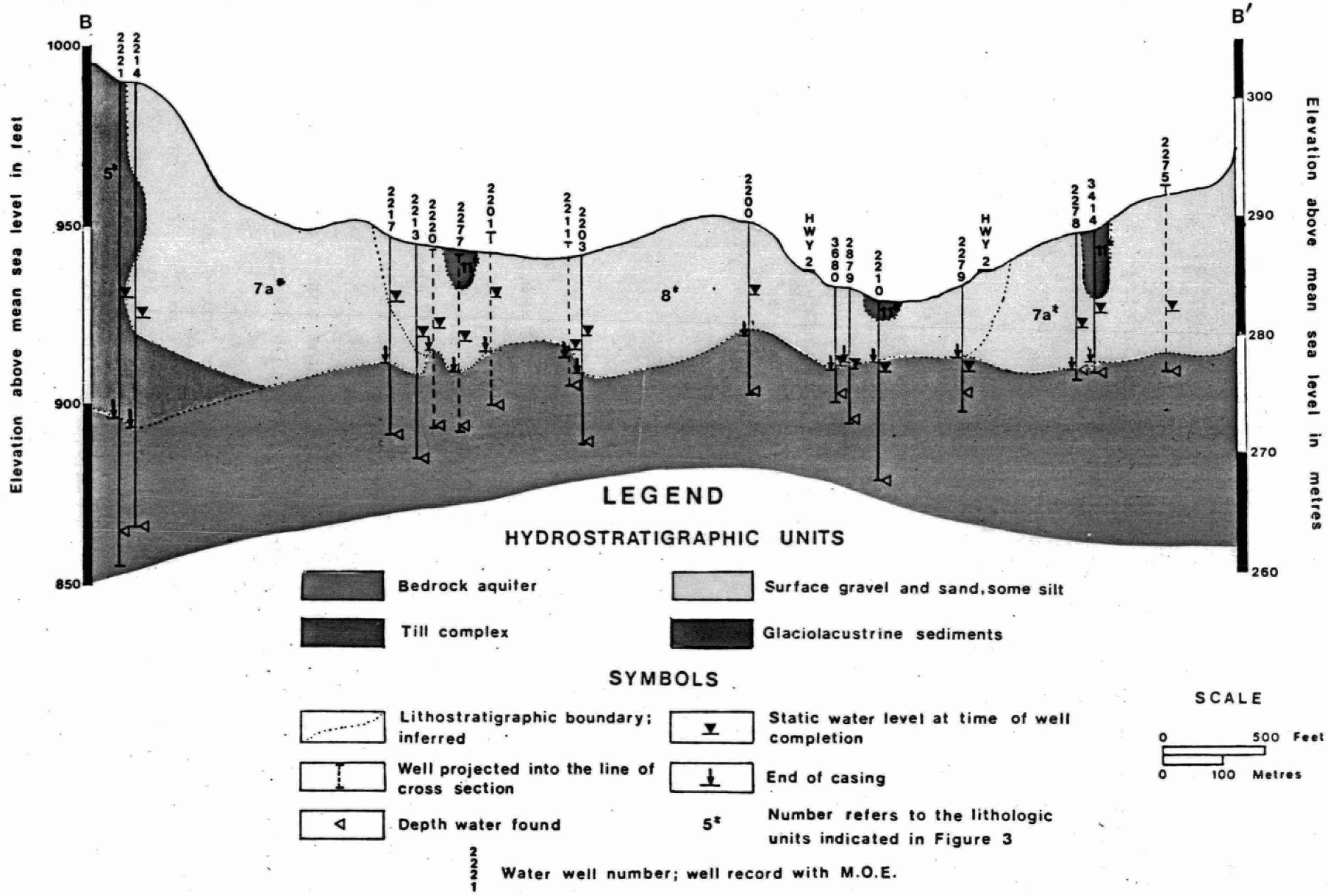


FIGURE 5 . VERTICAL SECTION B-B' SHOWING SEQUENCE AND DISTRIBUTION OF HYDROSTRATIGRAPHIC UNITS.

Section location is shown in Figure 1.

to 10 feet (3 m) in thickness. The importance of this unit is viewed as an attenuating medium for the septic tank effluent and for any other pollutants which may originate at the ground surface. The correlation between the presence of this unit and the amount of nitrate in corresponding well waters is established further on in this report.

2.1.5 Recent Alluvial Sediments

Mixtures of sand, gravel, silt and some clay comprise this unit which occupies a limited area along the floodplain of the Thames River. It may also contain channel and bar gravels overlain by floodplain silts, sands, and muck. This material is poorly sorted and has low permeability.

2.2 Groundwater Flow in the Bedrock

In order to have flow in a groundwater reservoir, the water must have an initial store of mechanical energy in the form of fluid potential (Hubbert, 1940). Hence, groundwater flows under the influence of gravity following the most direct route from points of higher potential to points of lower potential. Contours of equal potential in the bedrock aquifer system give the direction of groundwater flow as well as the distribution of recharge and discharge zones.

Information obtained from water well records penetrating bedrock and filed with the Ontario Ministry of the Environment (MOE) were used to infer directions of groundwater flow in the bedrock aquifer.

Potential distribution in the bedrock aquifer as inferred from water well records is shown in Figure 6. It indicates that the landfill site is located in a recharge-transient zone of the bedrock aquifer system. Groundwater, generally moves downward and then horizontally in a northwesterly direction. The Thames River is considered to be the discharge zone for the bedrock aquifer flow system in this area.

Figure 6 also indicates that the deeply incised "valleys" into overburden deposits influence the hydraulic head distribution in the bedrock aquifer system. This situation is apparent in the area between the Denby landfill site and the Thames River (Figure 6), where the potentiometric contours have formed a local "potentiometric valley" which is more pronounced than the physiographic valley at the ground surface.

2.3 Hydrogeology in the Vicinity of the Denby Landfill

The vertical cross section shown in Figure 4 illustrates the distribution of geological and hydrogeological units at and below the landfill site and in the nearby wells. It is not certain, however, whether the till complex unit is continuous as shown in Figure 4. The location of well No. 2204 which indicates the absence of the aquitard material at the bedrock surface has not been confirmed. Therefore, information from this well has not been utilized in constructing Figure 4.

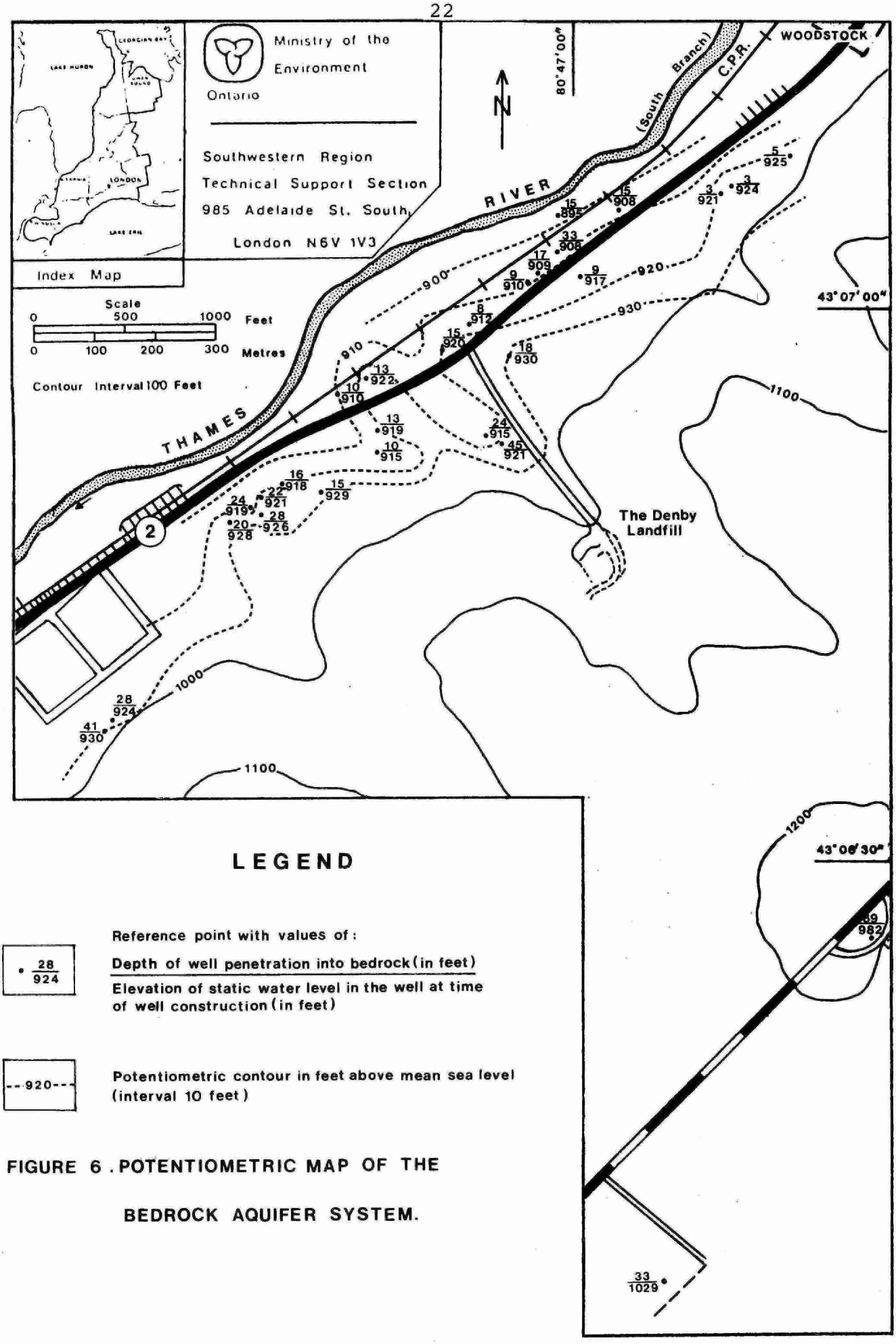


FIGURE 6. POTENTIOMETRIC MAP OF THE BEDROCK AQUIFER SYSTEM.

Information from water well records indicates the absence of water in the overburden in the vicinity of the landfill site and in the study area in general. It is therefore reasoned that the same situation prevails at the Denby landfill (Figure 4). Hence, the refuse was initially buried in trenches probably less than 10 feet (3 m) in depth under unsaturated conditions. However, a large amount of solid wastes were deposited at and above ground surface, then compacted and covered by granular material (Photo 4).

As shown by studies in Illinois (Hughes, Landon and Farvolden, 1971), infiltration through landfill covers does occur resulting in groundwater mounds within the landfill. Evidence of mounding at the Denby sanitary landfill site has not been observed. However, slight leakage and ponding of "leachate" was observed in the northwestern portion of the landfill site (Photo 4). A fluid sample was collected from this point (2L in Figure 1 and Appendix C) and analysed. It is considered that this occurrence of "leachate" at the ground surface was of a local significance only and was not a part of an extensive groundwater mound development.

The movement of leachate from the refuse toward the bedrock constitutes a pollution hazard for the bedrock aquifer system. The thickness of granular material at the Denby site is about 40 feet, while the underlying till deposits are about 60 feet in thickness. Assuming a permeability of the granular material of 5.5×10^{-3} cm/sec and a permeability of the till complex unit of 1.0×10^{-6} cm/sec, the travel time for leachate to reach the bedrock is about 9 years. This calculation assumes that the values of permeability apply over the entire thickness of the respective hydrostratigraphic units and that the leachate moves downward vertically. However, it is reasoned that the lateral movement of leachate toward the Thames River occurs before it initially

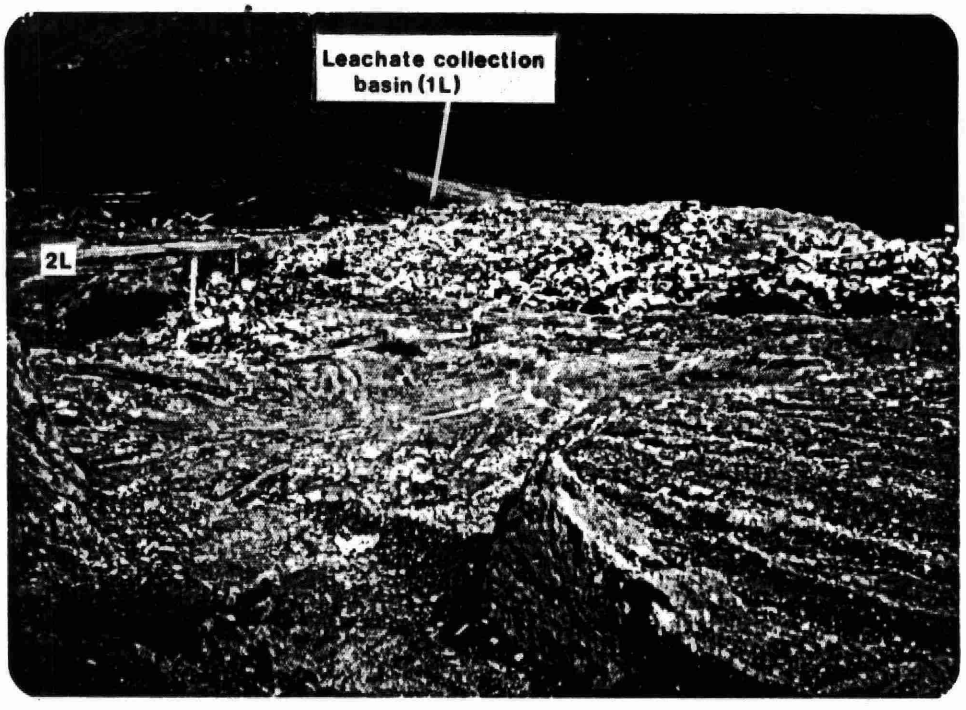


Photo 4. The Denby landfill site looking north. Refuse is piled up and compacted in the northern portion of the site and periodically cover with sand, silt and gravel.

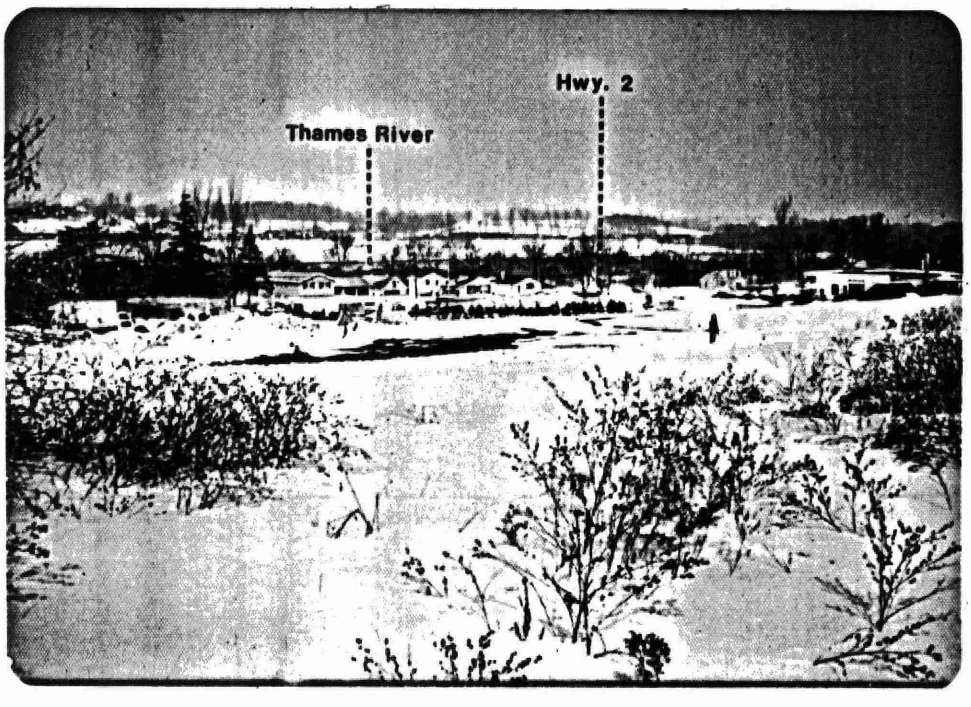


Photo 5. Septic tank effluent is spread on the land during the winter months also.

reaches the bedrock. The interface between the silty gravel and sand unit and the underlying till unit is most likely the zone where lateral movement of leachate first occurs. The movement of leachate is futher influenced by: (a) the thickness of the saturated zone in the overburden, (b) the presence or absence of aquitard material resting directly on the bedrock and (c) by anomalous hydraulic head distribution in the bedrock aquifer system. Whichever complex path leachate movement takes, there is no doubt that the general direction is toward the Thames River, which is considered to be a discharge zone of the bedrock aquifer system.

CHAPTER 3

GENERATION, ATTENUATION AND MOVEMENT OF LEACHATE

The physico-chemical interaction between the leachate and the intervening glacial materials renovates the leachate and thereby reduces the impact on groundwater quality. The evidence shows that attenuation does occur as the leachate passes through the overburden, however this process appears to be insufficient to totally renovate the leachate with the result that the leachate enters the bedrock aquifer and pollutes the potable water supply.

A minor amount of leachate is derived shortly after emplacement of refuse during the initial compaction and settlement; however, most of it is produced at a later time when decomposition of the refuse reaches its maximum. The intensity of refuse decomposition depends on the initial waste composition, the presence or absence of oxygen, the time of burial, the age of the landfill, the degree of compaction, the temperature and the moisture content (Hughes, Landon and Farvolden, 1971). Water originating from precipitation will accelerate decomposition and will leach various organic and inorganic substances present in the refuse. The decomposition of refuse is aerobic in the early stages, but soon becomes anaerobic.

In the course of the migration through the ground the leachate is attenuated by dilution due to the infiltration of uncontaminated water, ion exchange, dispersion, diffusion, mechanical filtration, sorption, chemical precipitation, gaseous exchange and microbial activity. Although research is currently in progress in this regard, it is not

yet possible to understand fully the manner in which these attenuation processes function.Fine-grained sediments have a high capacity for attenuating contaminants, whereas sands and gravels have a lesser capacity. The rates of groundwater flow through fractured rocks are relatively high, but the rock can attenuate relatively small amounts of the components of the landfill leachate.

A literature review on the impact of leachate on groundwater quality reveals that the most obvious changes to be expected are increases in total hardness, alkalinity, calcium, magnesium, sodium, potassium, chloride and sulphate (Zonini, 1973). Other parameters such as iron, chemical oxygen demand (COD) and biological oxygen demand (BOD) may also show increases. Results of a recent investigation shows increases in total organic carbon (TOC), tannins and lignins and phenols but decreases in sulphate concentrations in conjunction with the presence of sulphate reducing bacteria in those wells affected by landfill leachate (Novakovic, 1976).

The most important gases generated by the landfill are carbon dioxide, methane, nitrogen and oxygen. They are released both to the atmosphere through cover material and to the surrounding ground and groundwater.

If the refuse in a landfill is placed above the water table then the amount of leachate produced will be approximately equal to the amount of infiltration into the landfill. In this area, there is a difference of approximately 12 inches (30 cm) between the average annual precipitation and the mean annual potential evapotranspiration. Considering that permeable granular material has been used to cover the solid wastes it is considered the 12 inches (30 cm) of infiltration is realistic. Applying this value over the 4-acre (1.6 ha) site would result in the production of 2 igpm (0.15 l/sec) of leachate on a continuous basis.

CHAPTER 4

GROUNDWATER QUALITY

In order to establish groundwater quality in the area of the landfill site, a water quality survey of the bedrock aquifer commenced in April, 1976. No special investigation such as drilling and establishing water quality monitoring wells at the landfill was carried out. Instead, the existing domestic wells completed into the bedrock were used to obtain water samples from the bedrock aquifer system.

In this section, reference is made to several of the existing wells by their particular number as they are shown in Figure 1. This is more practical than referring to the owner of any particular well. The corresponding names of the well owners are given in the Appendices of this report.

The summary of the chemical analyses is provided in Appendices B and C, while the bacteriological analyses are summarized in Appendices F and G.

Several wells which penetrated more than 15 feet (4.5 m) into the rock reported sulphurous water at the time of well completion, including 2207, 2210, 2280 and 3582.

4.1 Previous Investigation into the Contamination of Domestic Wells in the Study Area

The report entitled "Gasoline Contamination of Private Wells, Township of West Oxford" (Pitts, 1972) was issued by the Ontario Ministry of the Environment. The report summ-

arizes findings of an investigation into gasoline contamination of domestic wells carried out in 1970. The area investigated includes a portion of the present study area and extends about 1200 feet (366 m) east and 800 feet (244 m) west along highway 2 from the junction of the landfill access road to the Denby site and highway 2 (Figure 1).

The former report indicates three possible sources of gasoline, however the source of gasoline which had affected these domestic wells was not identified.

The report also concludes that increases in nitrate observed in a number of domestic wells likely originated from:

i) Domestic septic tank effluent.

ii) Spreading of the septic tank effluent on the land (as indicated in Figure 1 of this report; Photo 5).

iii) Disposal of septic tank effluent in the abandoned gravel pit (presently the Denby landfill site).

iv) A manure pile located at the southwest corner of the junction of highway 2 and the access road to the landfill.

The last three possible sources of nitrate contamination were owned or operated by the late E. Denby of R. R. # 1 Woodstock (of Denby and Sons Sanitation).

The report also notes that several domestic wells located north of highway 2 contained abnormally high concentrations of chloride due to road salt utilized on the highway.

4.2. Potential Sources of Groundwater Contamination

The characterization of background water quality in the bedrock aquifer is complicated by the present ongoing chemical reactions in the bedrock aquifer and by the existence of several potential pollution sources in the area. Some of these sources have been there for many years. These include:

1. Septic tank effluent disposal fields associated with every household.

2. Application of salt to highway 2 which passes through the residential area.

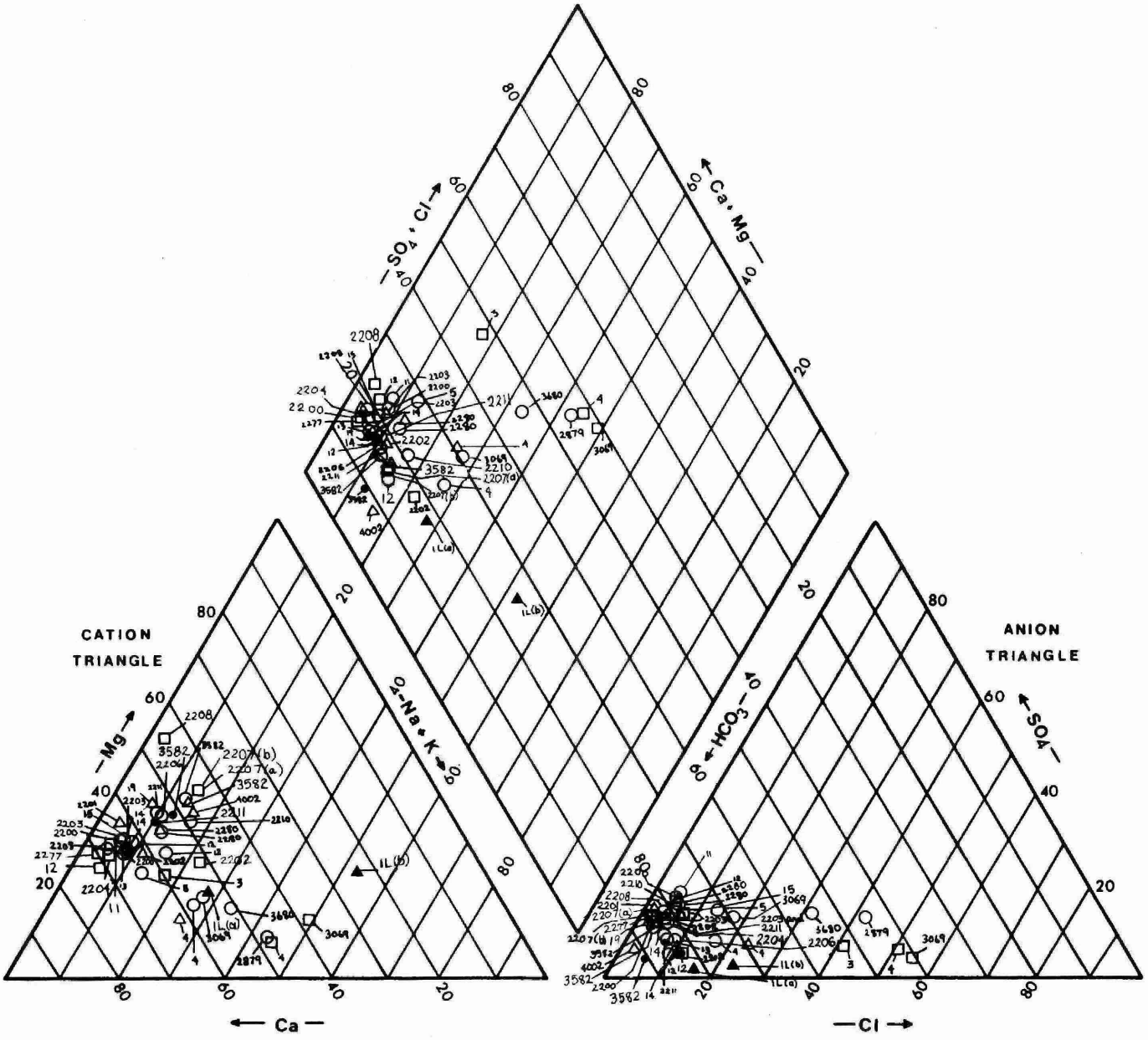
3. Operation of the Denby sanitary landfill site.

4. Spreading of septic tank effluent on the parcel of land located close to the domestic wells of several residences (Photo 5).

5. The barn manure and its associated pollutants, located uphill and upgradient of several residences.

6. The landfill leachate collected from the Denby sanitary landfill and disposed of in the wooded area southwest of the landfill site.

7. Installation of a private water treatment unit by several residents in the study area, which increases the concentration of sodium and chloride in the consumed water. Such water enters the groundwater system through septic tank disposal fields. Where water treatment is used, a representative water sample could not be obtained.



EXPLANATION

ANALYSES OF WATER

SYMBOL	DATE SAMPLED
□	07/07/70, 30/09/70, or 14/12/70
●	21/04/76 or 08/06/76
○	30/09/76 or 04/10/76
△	04/11/76, 15/11/76, or 23/11/76

ANALYSES OF LEACHATE

SYMBOL	DATE SAMPLED
▲	04/11/76 and 23/11/76

—2201 Water well number; location is shown in Figure 1

FIGURE 7. HYDROGEOCHEMISTRY OF WATER FROM BEDROCK AQUIFER AND OF LANDFILL LEACHATE.

Further analyses demonstrated that the last three potential sources of pollution have had no discernible effect on groundwater quality. However, the first three pollution sources and to a lesser extent the fourth source are adversely affecting water quality in the bedrock.

4.3 Deterioriation of Water Quality in the Bedrock Aquifer

The chemical analyses are presented in three modes: (1) the complete chemical analyses (those which include major cations and anions) are plotted on the trilinear diagrams (Piper, 1964) in Figure 7, (2) the complete chemical analyses are plotted on the semi-logaritmic diagrams (Figures 8 and 9, and Appendix D) as introduced by Schoeller (1937) and (3) each chemical constitutent is plotted in the chronological order of sampling on maps (Figures 10 to 14 and Appendix E).

One of the more obvious indicators of groundwater pollution is chemical oxygen demand (COD). This parameter is shown first in Figure 10 because it gives an instant overview of the number of wells whose quality has been affected. They are generally concentrated around the junction of the landfill access road and highway 2.

The chemical quality of water from wells located east of an imaginary line parallel with the landfill access road is similar. This portion of the study area is designated as subarea 1 (Figure 1), and is discussed separately.

4.3.1 Subarea 1

As expected, the water chemistry plotted on the Piper

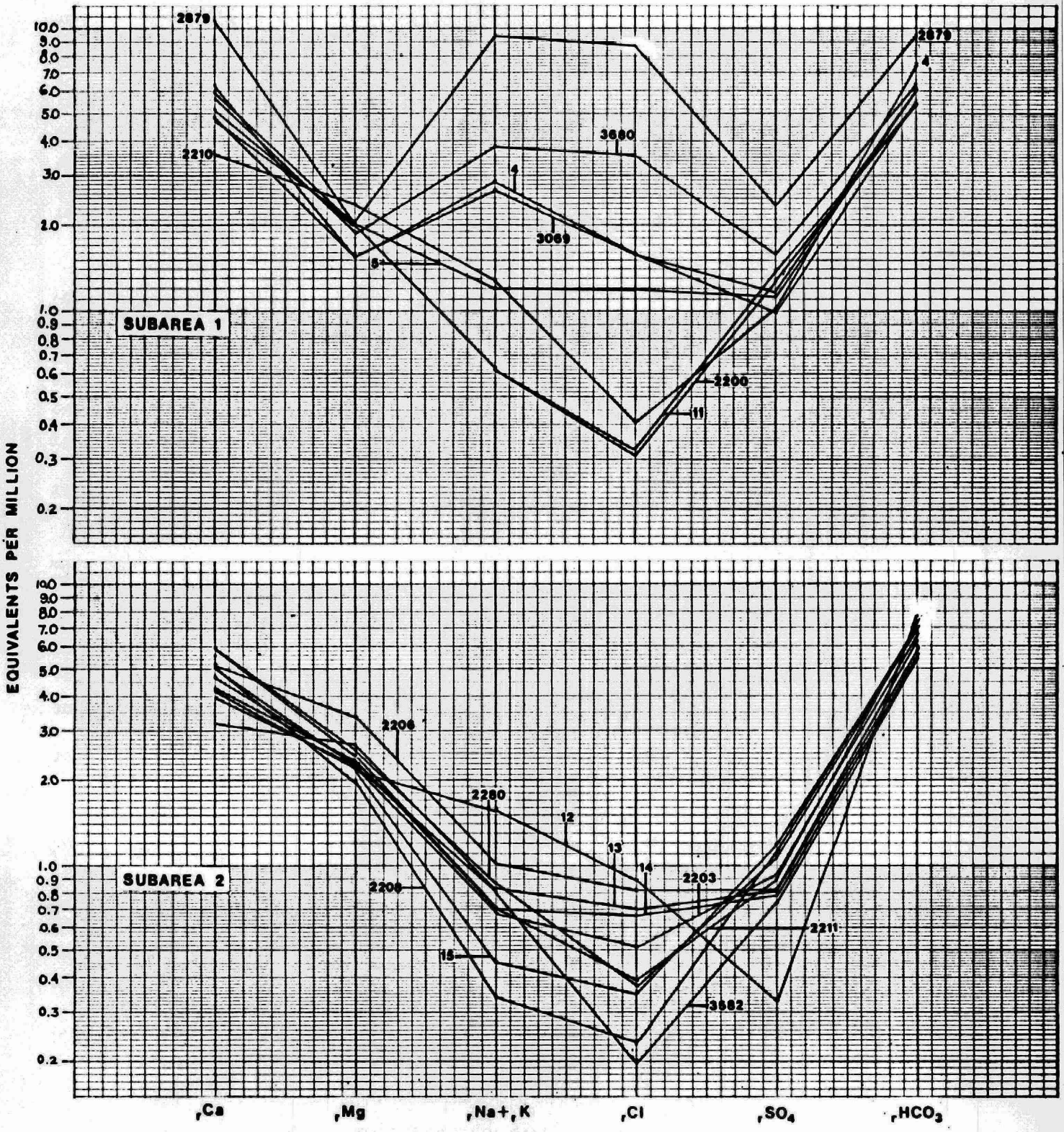
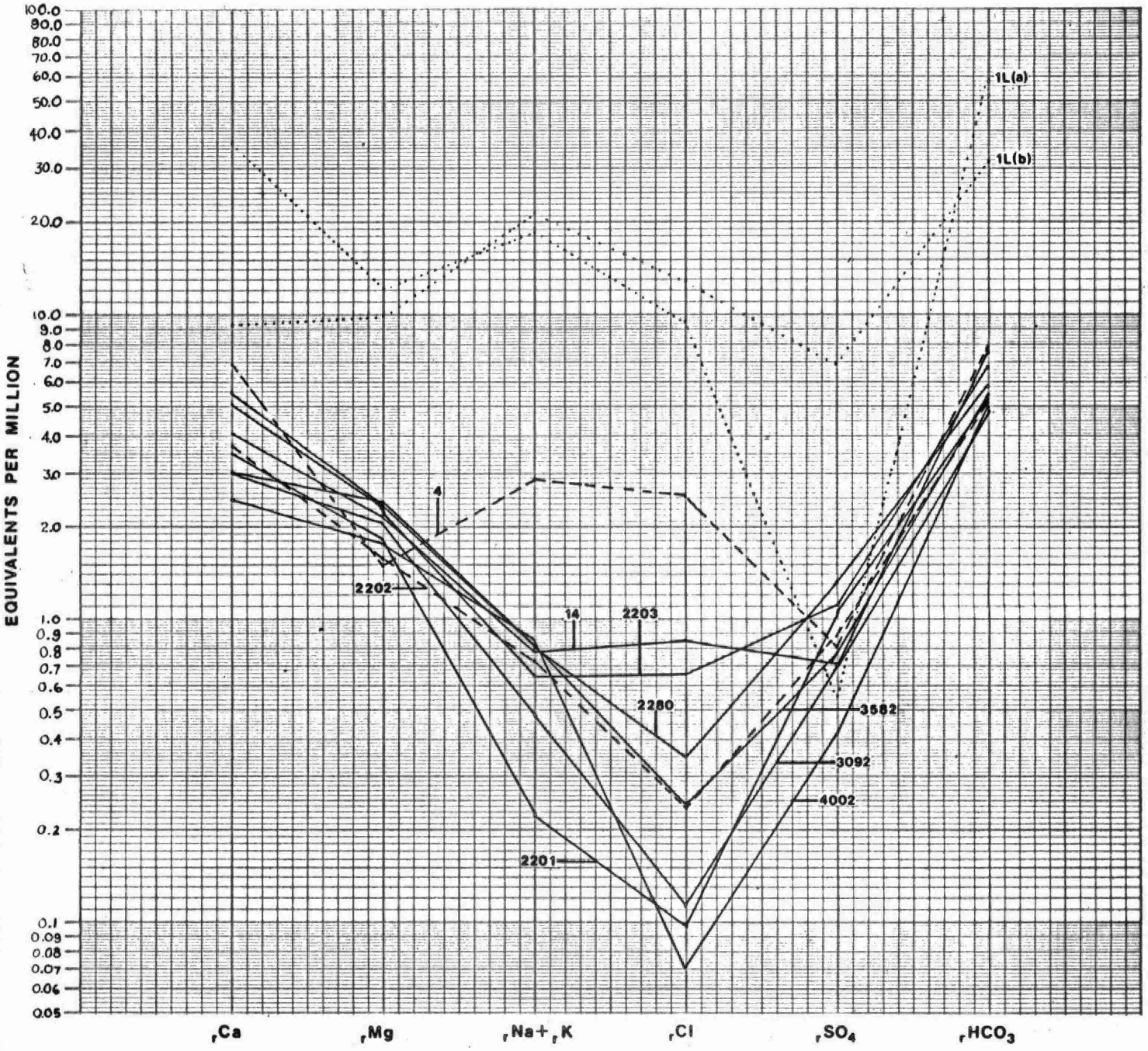


FIGURE 8. SEMI-LOGARITHMIC DIAGRAM OF THE CHEMICAL ANALYSES OF WATER FROM THE BEDROCK AQUIFER.

diagram indicates groundwater in the bedrock aquifer to be calcium-bicarbonate in type (Figure 7). No substantial changes in water quality occurred in the wells monitored during 1976, however the diagram does indicate that the chemical analyses from several wells fall within the central portion of the rhombohedron. These wells are confined within a small area along highway 2 and the majority of them are located on the north side (downslope) of it. A further examination of these analyses indicates that they contain relatively large amounts of sodium and chloride which are components of common salt.

An examination of chloride and sodium concentrations in domestic wells from subarea 1 reveals that they are elevated during late spring and early summer (Figure 11). However, the concentration gradually decreases during the summer and early autumn indicating a non-permanent source. It is therefore postulated that chloride and sodium are indirectly introduced into the bedrock aquifer system by highway de-icing during the winter months. The fact that the concentrations of sodium and chloride decrease at varying rates from their spring-time peaks is explained by: (i) variations in local lithology (ii) variation in the intensity and occurrence of precipitation (iii) distances of the various wells from the road (iv) differing topographic gradient and (v) differing groundwater gradients.

Increases in sodium and chloride concentrations in groundwater are reflected by the position of the chemical analyses on the triangular diagram in Figure 7. Using chloride and sodium as indicators of groundwater pollution originating from salt used on the road, wells designated by the following numbers (Figure 1) have been affected: 1, 4, 2276, 2210, 2879, 3680, 5, 3069, 2202, 11, 2200. The degree to which these wells have been affected varies, but the



KEY

····· Landfill Leachate - - - - Subarea 1 (wells) —— Subarea 2 (wells)

DATE SAMPLED: November 15 or November 23, 1976

FIGURE 9. SEMI-LOGARITHMIC DIAGRAM OF THE CHEMICAL ANALYSES OF WATER FROM THE BEDROCK AQUIFER AND OF LANDFILL LEACHATE.

concentration of chloride and several other chemical constituents in number of these wells does exceed the recommended limit of 250 mg/l for drinking water set by the Ministry of the Environment (1973).

4.3.2 Subarea 2

This area includes wells located west of the landfill access road (on both sides of highway 2) and it is bounded on the west by an imaginary northwest-southeast line passing approximately through well 15 (Figure 1).

The concentrations of chloride and sodium in the wells located in this subarea show an entirely different pattern than wells located in subarea 1 (Figure 11). Both chloride and sodium are slightly increased above the background concentrations, which are approximately 5 mg/l for chloride and 4 mg/l for sodium. However, during the monitoring period (from April to November, 1976) very slight variations (decrease then increase) of both ions were observed, indicating a persistent source (Figure 11).

Another difference from wells in subarea 1 is the increased concentrations of iron and phenols in all wells located in this subarea (except in those located north of Highway 2, Figure 10). The degree to which the water quality in these wells has changed varies throughout the year and it also depends on the locations of particular wells. The greatest changes are experienced in well 12. This well seems to be located in the "main avenue" of the movement of polluted groundwater.

Analyses of the local hydrogeological environments and the distribution of the hydraulic potential in the bedrock

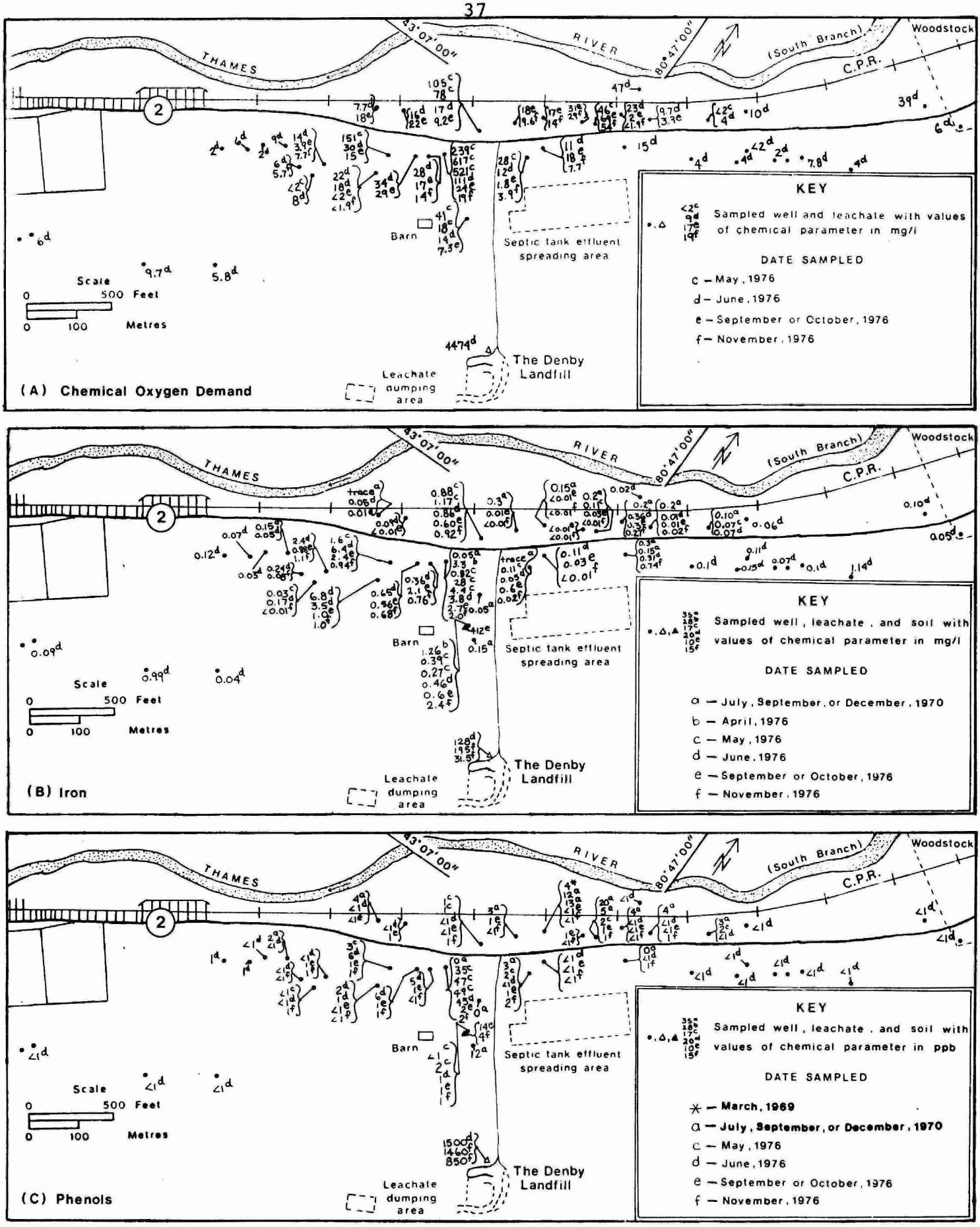


FIGURE 10. HYDROGEOCHEMICAL MAP OF CHEMICAL OXYGEN DEMAND (A), TOTAL IRON (B) AND PHENOLS (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN THE LANDFILL LEACHATE.

aquifer (Figure 6) supports the pattern of groundwater quality changes observed in the domestic wells in subarea 2. Hence, the deterioration of groundwater quality in subarea 2 is due to the introduction of landfill leachate components into the groundwater. The leachate is being generated at the Denby landfill. The sequence and the distribution of the hydrostratigraphic units at the landfill and in the nearby wells (Figure 4) explains why the water quality in well 3582 (the nearest to the landfill) has not deteriorated as badly as that in well 12. Although the 10 feet (3 m) of silty clay (till complex unit) resting on the bedrock surface was reported in only two wells along the line of cross section shown in Figure 4, it is certain that its presence plays an important role in defining the movement of the leachate and in determining the impact of leachate on water quality in nearby wells and in the carbonate aquifer in general.

That the components of landfill leachate are moving towards the Thames River is supported by other observations. For example, tannins and lignins were detected only in the well nearest to the landfill (well 3582). Furthermore, analyses of the soil samples taken from the well pit (well 3582; about 6 feet (1.8 m) below ground surface) indicates the presence of hardness, phenols, iron and sulphate in higher than normal concentrations. This soil enrichment in these chemical parameters is due to the leachate which has moved through it.

Although it is difficult to assess the degree to which individual domestic wells have been contaminated by landfill leachate, it is considered that the following wells (Figure 1) represent the core of the adversely affected areas: 3582, 12, 13 14, 2203, 2211 and 15. This contamination is experienced to a lesser degree in the wells located on the periphery of subarea 2 such as in wells 2280, 2206, 2208 and perhaps 2200.

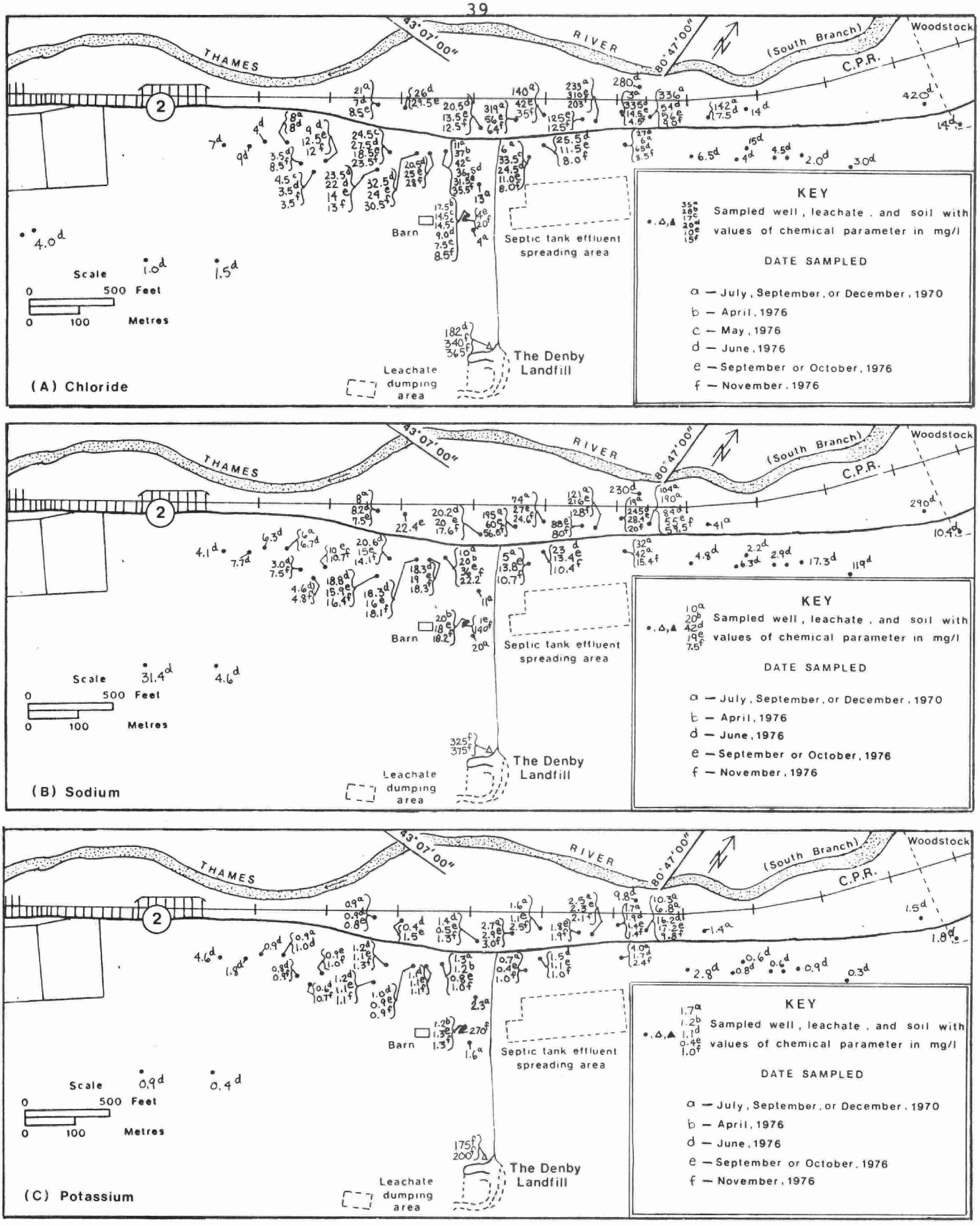


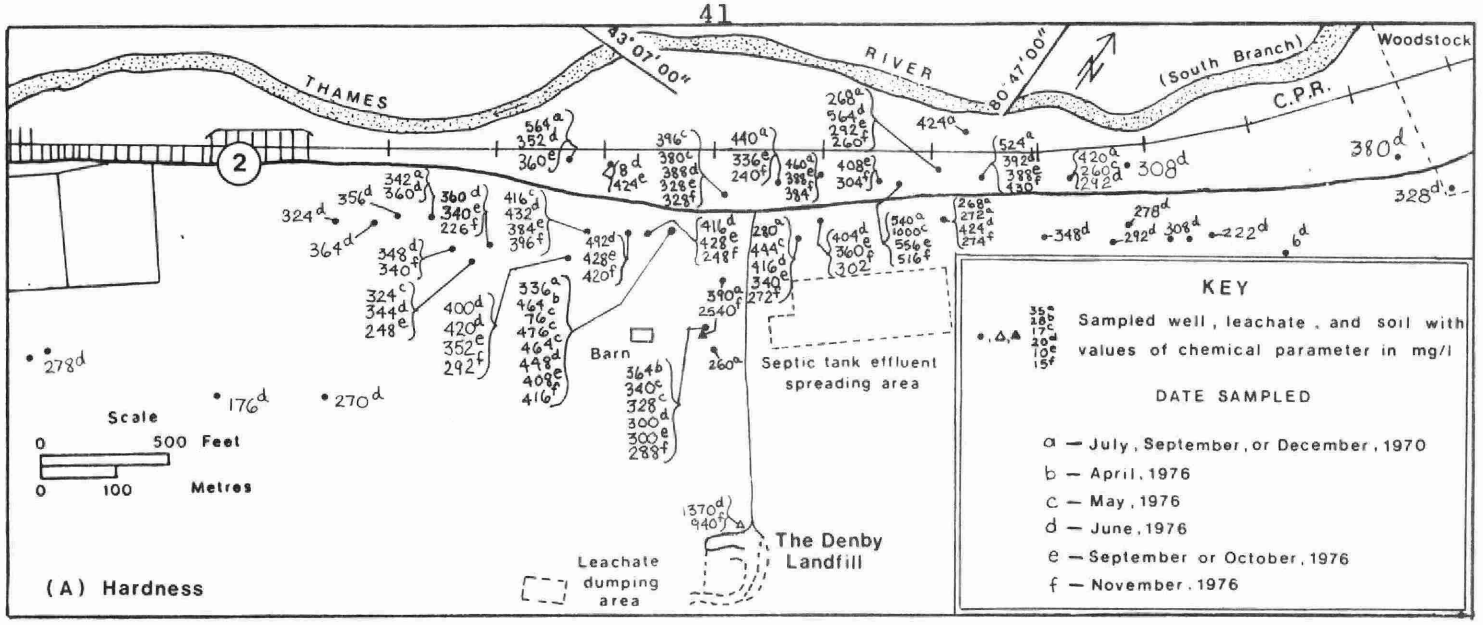
FIGURE 11. HYDROGEOCHEMICAL MAP OF CHLORIDE (A), SODIUM (B) AND POTASSIUM (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN THE LANDFILL LEACHATE.

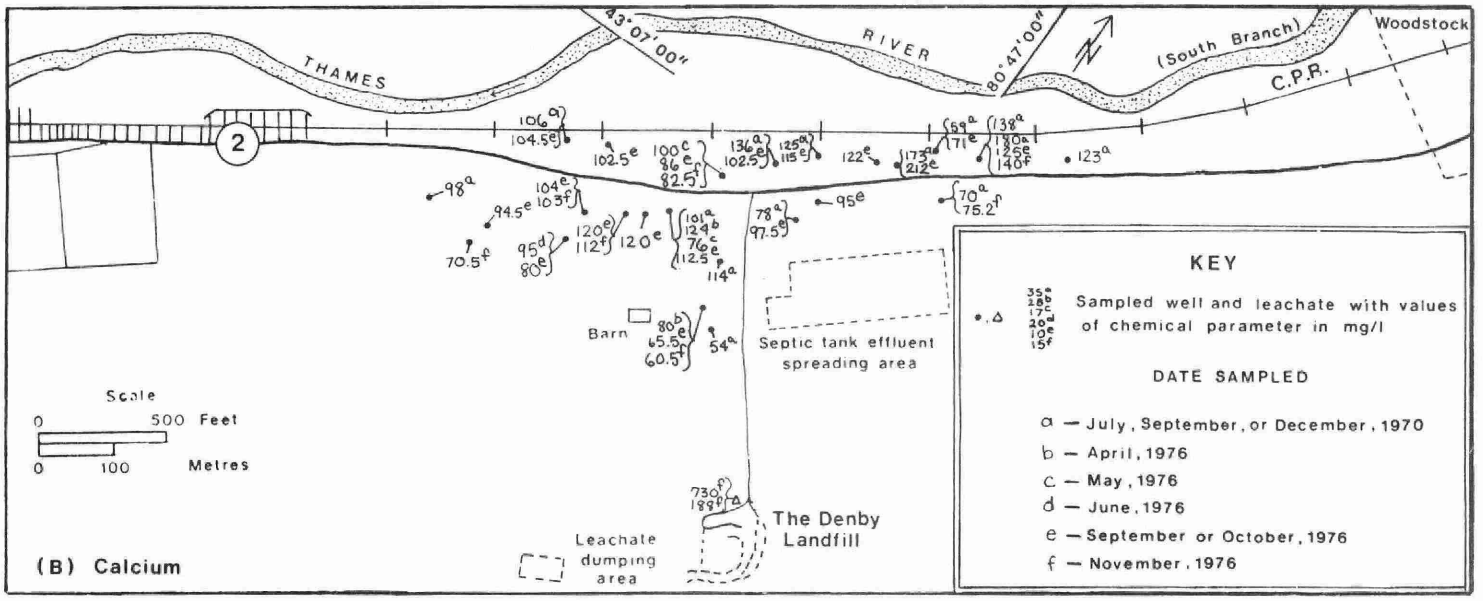
In several of the affected wells the concentrations of iron, phenols, total dissolved solids and total organic carbon exceed the recommended limits for drinking water (Figures 10, 13 and 14).

4.3.3 Schoeller Chemical Diagrams

The Schoeller plot (Schoeller, 1937), depicts the 7 major dissolved ions on equidistant verticals. By joining the points on the vertical lines a single analyses is represented in linear fashion. Waters of similar composition plot as nearly parallel lines. This graph is especially useful for comparing waters which do not differ greatly in composition.

Two Schoeller plots, shown in Figures 8 and 9 were prepared from the analytical results of waters collected from wells in the study area in September or October, 1976 and November 1976. The complete chemical analyses collected on other dates are also presented by use of Schoeller diagrams and are shown in Appendix D. In these diagrams contaminated well waters are identified by convex traces of analyses from wells 2879, 3680, 4, 3069 and 5. However, deviations from the general pattern are often due to changes in the local lithology, or to the presence of sulphate reducing bacteria in the wells. Such is the case in well 12 in Figure 8 and in the leachate sample 1L(a) in Figure 9. Mixing of the background quality water (containing low sodium chloride concentrations) with the sodium chloride water is apparent in the systematically decreasing slopes of the lines representing the water quality.





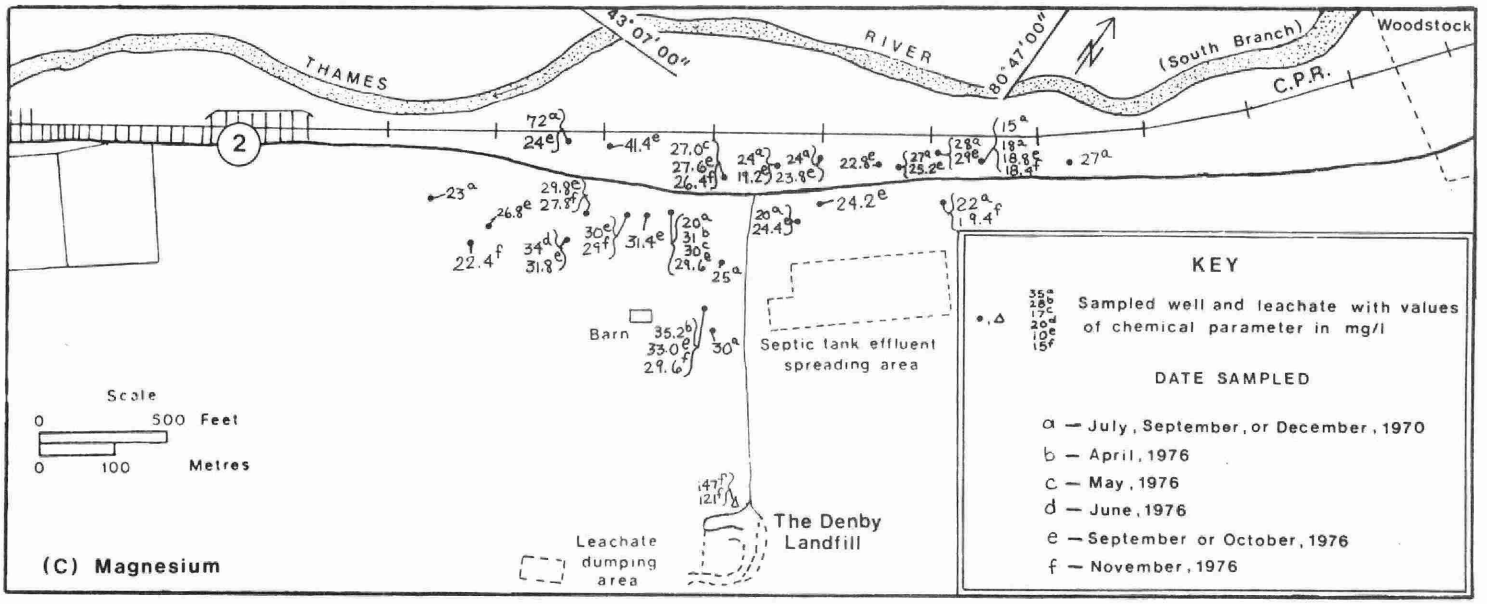


FIGURE 12. HYDROGEOCHEMICAL MAP OF HARDNESS (A), CALCIUM (B) AND MAGNESIUM (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN THE LANDFILL LEACHATE.

Background water quality is represented by chemical analyses from wells 3092, 4002 and 2201 (Figure 9). The concave-shaped diagrams of the chemical analyses from these wells is apparent.

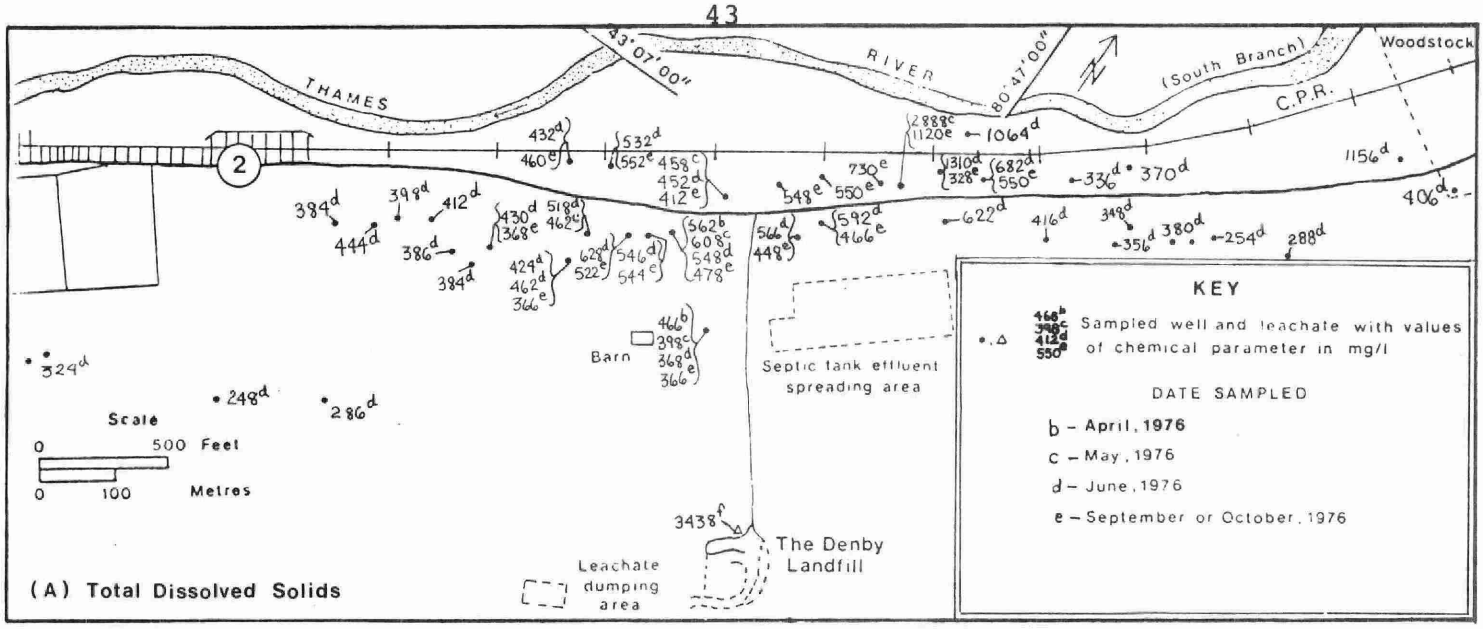
4.3.4 Nitrates and Potassium Concentrations in the Bedrock Aquifer

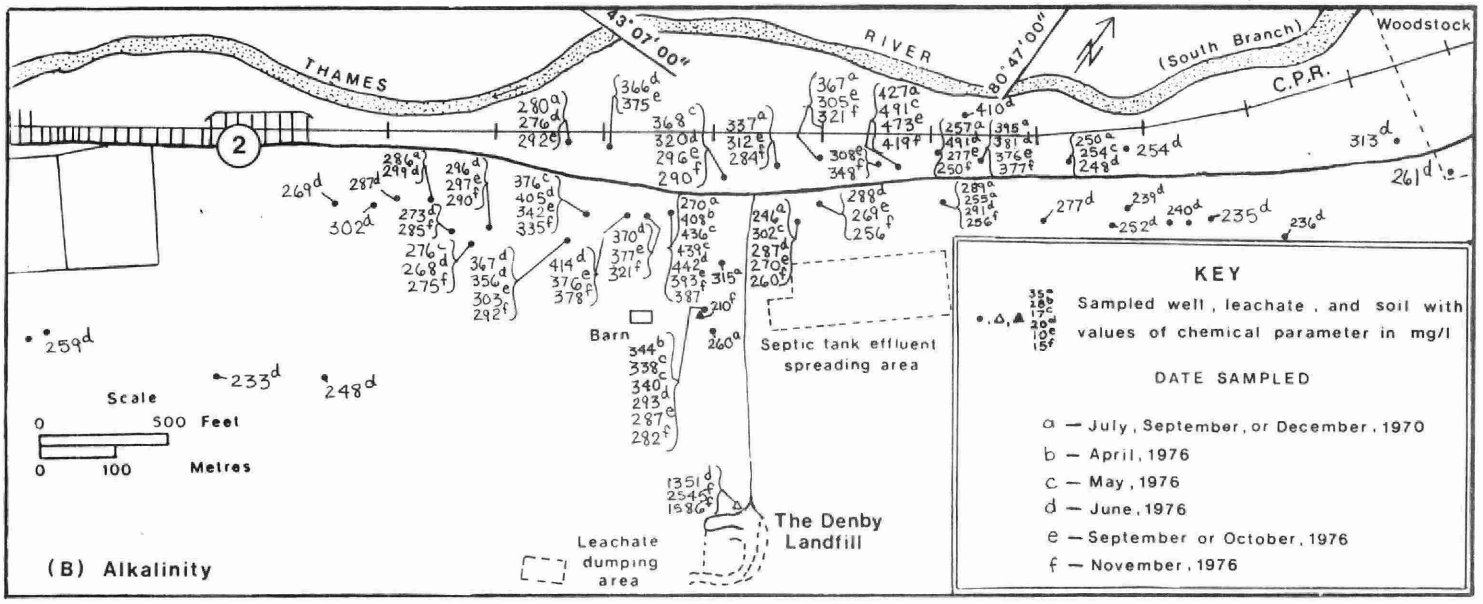
Nitrate is the end product of the aerobic stabilization of ammonia, organic nitrogen and nitrate, and as such it occurs in polluted waters that have undergone aerobic biological processes. Nitrate also occurs in percolating groundwater as a result of excessive applications of fertilizer or leaching from septic tank systems.

The Ontario Ministry of the Environment's Guidelines and Criteria (1973) for drinking waters recommends a limit of 10 mg/l nitrate as nitrogen. This limit was established because of the relationship between high nitrates in water and infant methemoglobinemia.

Infant methemoglobinemia, a disease characterized by certain specific blood changes and cyanosis, may be caused by high nitrate concentrations in water used for preparing feeding formulae. It seems likely that not all infants are susceptible to nitrate poisoning, but some are predisposed to it by physiological conditions. Many well waters containing over 500 mg/l of nitrate, as nitrogen have never been linked with reported cases (McKee and Wolf, 1963).

The background concentration of nitrate in unaffected wells is less than 0.01 mg/l. However, in many sampled wells it shows a considerable increase, the highest reported





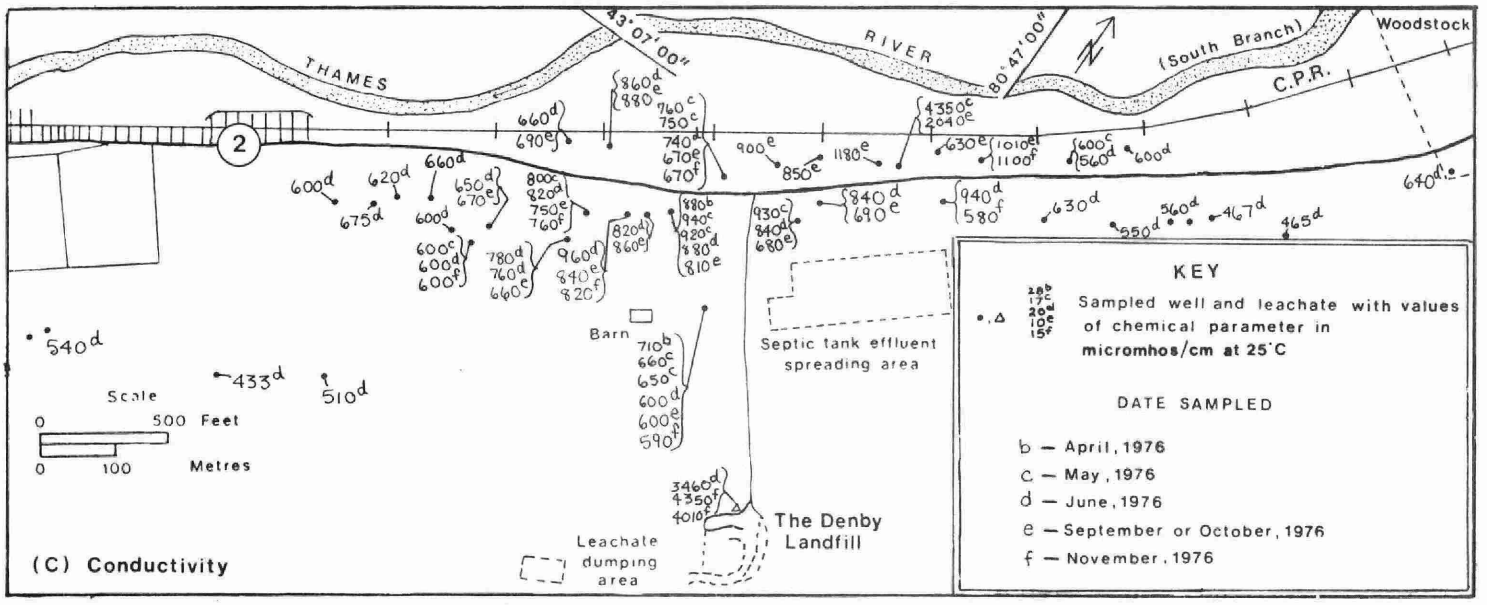


FIGURE 13. HYDROGEOCHEMICAL MAP OF TOTAL DISSOLVED SOLIDS (A), TOTAL ALKALINITY (B) AND CONDUCTIVITY (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN THE LANDFILL LEACHATE.

concentration being 8.1 mg/l (Figure 14). The elevated concentration of nitrate in domestic wells is indirectly related to the leaching of septic tank effluent into the bedrock aquifer.

Potassium also shows an increase in numerous domestic wells. The background concentration of potassium in unaffected wells is up to 1.0 mg/l whereas the highest reported concentration of potassium in a contaminated well is 16.2 mg/l (Figure 11). Both nitrate and potassium show similar trends in the wells such as: (1) both parameters increase downgradient from the sampled septic effluent disposal fields, (2) where the low permeability sediments are present (either resting on the bedrock, or at the ground surface) no significant increase in either chemical parameter occurs. The same situation applies to organic nitrogen, which, in many wells exceeds the recommended limit of 0.15 mg/l for drinking waters (Figure 14). This is obvious supportive evidence that the sources of these nitrogen compounds and potassium are related to domestic septic tank systems.

It is also noted that there is no obvious increase in nutrients and potassium in the wells located in the immediate vicinity of the portion of land used for spreading of the septic tank effluent. This leads to the conclusion that this practice has had no discernible effect on the quality of the bedrock aquifer system.

It has been calculated that the residents in the study area (excluding the Dorland Subdivision) generate 51,150,000 lb/year (23,250,000 kg/year) of domestic sewage. After it passes through field tile beds this effluent contains 3.4 mg/l of organic nitrogen and 17 mg/l of nitrate (Bond, Straub and Prober, 1974). Using these figures, the calculation

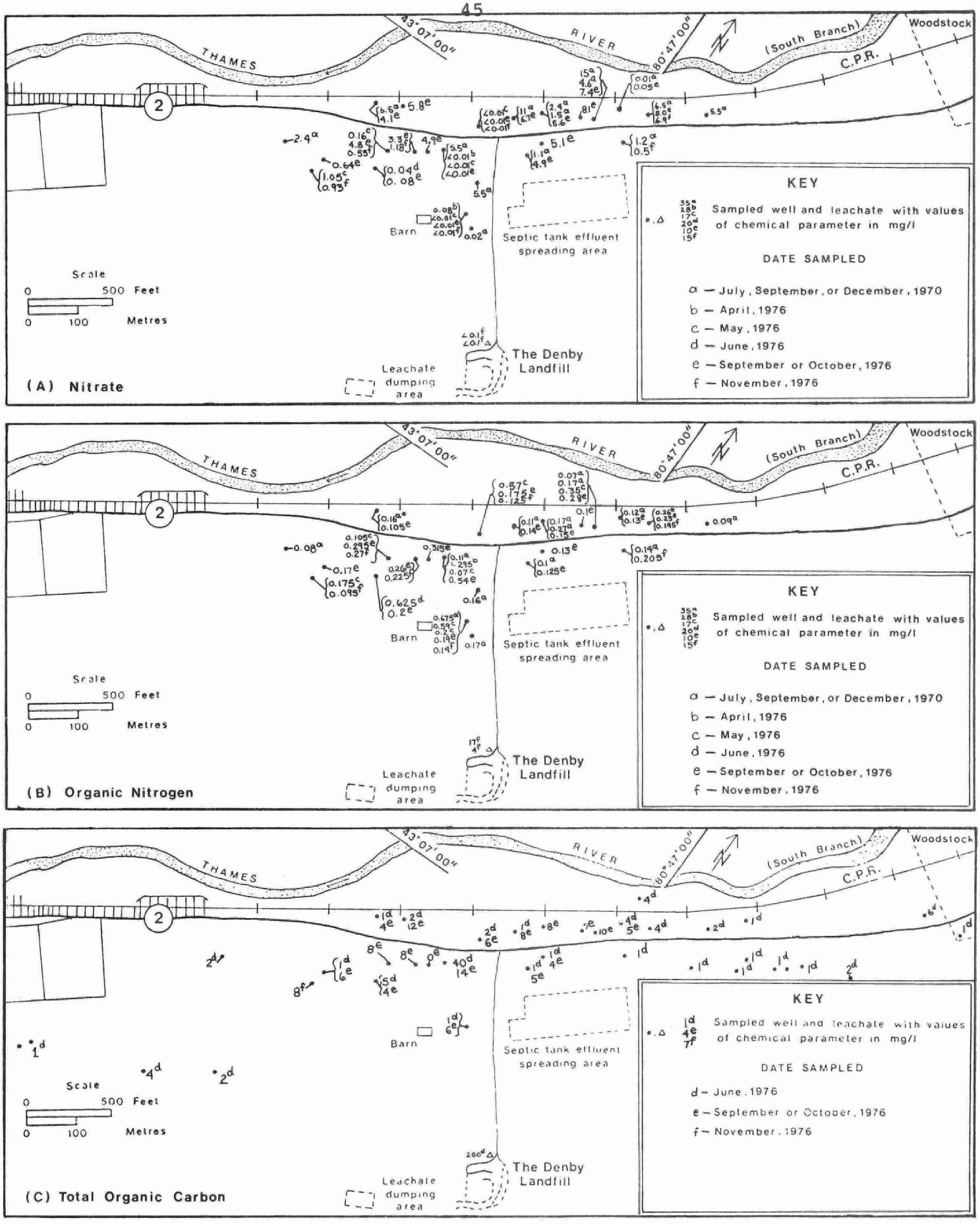


FIGURE 14. HYDROGEOCHEMICAL MAP OF NITRATE (A), ORGANIC NITROGEN (B) AND TOTAL ORGANIC CARBON (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN THE LANDFILL LEACHATE.

shows that a yearly input into the bedrock aquifer from these sources is 176 lb (80 kg) of organic nitrogen and 880 lbs (400 kg) of nitrate.

The concentrations of the nutrients and other chemical species entering the bedrock aquifer are controlled by: (1) the dilution capabilities of the aquifer itself, (2) dilution by a large amount of infiltration reaching the aquifer through overlying gravel and sand deposits, (3) dilution by a large amount of groundwater which flows from upgradient direction through the study area and discharges into the Thames River and (4) numerous additional attenuating processes.

4.4 Additional Interpretation of Groundwater Quality

The hydrochemical distribution suggests that the dominant controlling mechanisms may be: (1) dilution, (2) a combination of carbonate buffering and sulphate reduction and (3) the existing hydrogeologic framework. However the observed changes in groundwater chemistry point to a minor chemical reaction which may be partially superimposed on the carbonate equilibrium system.

The chemical reaction which is taking place in several wells is sulphate reduction. This process is incompletely understood and depends in part on the form of available organic carbon. Interpretative difficulties are experienced here due to the reported natural presence of hydrogen sulphide in several wells. Nevertheless, the correlation between sulphate concentration and the presence of sulphate reducing bacteria has been established (Appendix E) in several wells, including two wells located close to the landfill site (wells 12 and 3582 in Figure 1). This confirms earlier findings (Novakovic, 1976) that the reducing

environment within the landfill has been introduced into the bedrock aquifer and has engulfed the nearest domestic wells, thus stimulating the observed ongoing sulphate reduction.

The increases in hardness, alkalinity, total dissolved solids and to a minor extent calcium and magnesium (Figures 12 and 13) are related to the introduction of salt components in subarea 1 and by the introduction of landfill leachate in subarea 2. The highest reported concentrations of these components in the monitored wells was in late spring and early summer. The decreasing concentrations in total hardness, alkalinity and total dissolved solids towards the late autumn is not supported by an apparent decrease in calcium and magnesium concentrations. It is reasoned however, that this inconsistency is associated with the calcite-dolomite equilibria in the carbonate aquifer.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Several residents in the study area have experienced serious deterioration of their well water quality. Their complaints to the London Regional Office of this Ministry resulted in an extended well water sampling program. The analytical results of this program have indicated that there are three measurable sources of the carbonate aquifer pollution: (1) the Denby landfill, (2) salt used to remove the ice from provincial highway 2 and (3) septic tank effluent. There is evidence that pollutants originating from these sources are entering the bedrock aquifer system, resulting in contamination of individual domestic well water supplies.

Water quality impacts from de-icing operations and from septic tanks effluent were noted in a 1972 Ministry's report and have likely been affecting local water supplies for some considerable period. The introduction of leachate from the Denby landfill, however is a relatively recent and highly visible occurrence causing unpleasant taste and odours as well as discolouration of well water supplies. While all three sources are responsible for identifiable pollutants in local water supplies, the landfill leachate must be regarded as the most critical input.

The wells sampled are located in the area overlain by gravel and sand deposits of glaciofluvial origin that are highly permeable. Underlying this surficial material at depths ranging from 15 to 47 feet (4.5 to 14 m) is highly factured limestone bedrock of the Bois Blanc Formation of Paleozoic age. The bedrock aquifer from which all sampled wells obtain water yields hard, but good quality water.

However, hydrogen sulphide was reported in several wells at the time of their completion. The potable bedrock groundwater is particularly vulnerable to the infiltration of pollutants because of the permeable nature of the overburden materials.

There is no evidence as to whether the permeable material is saturated or not. Groundwater movement in the bedrock aquifer system is in the northwesterly direction with the Thames River as the discharge zone. Hence, the Denby landfill is situated such that it is a potential source of pollution to those water wells located downgradient from it.

The contaminated wells contain anomalously large concentrations of iron, phenols, chemical oxygen demand, total organic carbon, chloride, sodium, potassium, hardness, total dissolved solids and organic nitrogen.

5.1 Iron

It is characteristic for the wells in the immediate vicinity of the landfill to exhibit an increased iron concentrations. The recommended limit of 0.3 mg/l of iron is exceeded in these wells; however, in several wells located in the broader area, the natural concentration of iron is also elevated. Limits of iron in drinking water are not based upon physiological considerations, since iron in trace amounts is essential for nutrition. Indeed, large quantities of iron are taken for therapeutic purposes. The daily nutritional requirement is 1 to 2 mg and most diets contain 7 to 35 mg per day with an average of 16 mg.

The limit of 0.3 mg/l is based on esthetic and taste considerations. Iron tends to precipitate in hydroxide form and stain laundry and porcelain fixtures. It has also been reported that ferric iron combines with the tannin in tea to produce a dark violet colour. The highest reported iron concentration in a contaminated well is 4.4 mg/l.

5.2 Phenols

The ingestion of concentrated solutions of phenols can result in severe pain, renal irritation, shock and possibly death. It is not likely, however, that harmful concentrations of phenols will be consumed in drinking water because such concentrations are much higher than taste considerations would allow. A permissible limit for the concentration of phenolic compounds of 0.001 mg/l has been set because of tastes resulting from the action of chlorine on such waters.

The domestic wells in which phenolic compounds are present are confined to a small area immediately downslope from the sanitary landfill site. The highest reported concentration of phenols in a contaimedated well was 0.049 mg/l.

5.3 Chloride

Chloride ions are present in all natural waters and because of their physico-chemical characteristics they are transported by water through most rock materials, undergoing

relatively little retardation or loss. While the chloride concentrations in several sampled wells exceed the taste threshold, it is doubtful that the choride ion itself is physiologically harmful at anything but extremely high concentrations. Chloride criteria applied by various regulatory agencies seem to be based primarily on taste threshold values. In general, it is assumed that it is the cations (calcium, magnesium, sodium or potassium) associated with chloride that produce a harmful effect. Background chloride concentrations in the study area average 5 mg/l which is approximately 84 times less than the concentration of chloride in the well most affected by road salting but 8 times less than in the wells affected by the landfill.

5.4 Sodium

Sodium too is found in measurable amounts in all natural waters. It does, however, enter into ion exchange reactions making it unsuitable as a tracer ion. Large concentrations of sodium ions in drinking water may be harmful to persons suffering from cardiac, renal and circulatory diseases. While recommended limits vary from 10 to 115 mg/l it should be assumed that water from several of the affected wells (maximum reported sodium concentration was 290 mg/l) may be considered unfit for human consumption where "salt free" diets have been recommended by physicians.

5.5 Hardness

The increased hardness of water in the study area is directly related to the entrance of excess sodium, chloride, calcium and magnesium ions into the aquifer. In general,

the water in the study area is hard. With an increase of hardness due to the introduction of several chemical parameters in the carbonate aquifer system, the water has become excessively hard, and by some standards unsuitable for general domestic purposes. Hard water requires a considerable amount of soap to produce lather, and it usually deposits scale in hot water piping systems. Physiologically, however, hardness is not considered to be harmful to health.

Several residents have begun to use water softeners as a result of the increased hardness. In the water softener, calcium and magnesium ions are exchanged for sodium ions. Thus, softening water causes an increase in sodium ions. The discharge of this softened water water via septic tank systems into the aquifer results in further ion exchange reactions, and therefore a slight increase of hardness in the aquifer waters may be expected.

5.6 Nitrate and Organic Nitrogen

Increased concentrations of nitrate and organic nitrogen in the bedrock aquifer, in the absence of excessive use of fertilizer applications must be related to the leaching of septic tank effluent into the aquifer. In almost every sampled well, the concentration of the organic nitrogen (total kjeldahl minus free ammonia equals organic nitrogen) exceeds the recommended criterion of 0.15 mg/l set by this Ministry. However, the concentration of nitrate does not exceed the recommended limit of 10 mg/l for drinking water in any of the sampled wells. Concentrations of nitrate over the recommended limit is of concern because infant methemoglobinemia (blue babies), irritation of the mucous linings of the gastrointestinal tract and bladder and symptoms of

diarrhea and diuresis are all linked to the presence of excessive nitrate in drinking water (McKee and Wolf, 1963). The source of increased organic nitrogen and nitrate contamination are local septic tank systems, however it is also possible that a small amount of nitrate may originate from the spreading of septic tank effluent practiced on a nearby portion of land.

5.7 Conclusions

Calculations have shown that a large amount of water originating from precipitation infiltrates into the bedrock aquifer and that a considerable amount of groundwater flows through the affected area. These waters dilute the contaminants originating from the landfill and the other sources of pollution, therefore lessening the degradation of domestic water supplies and of the carbonate aquifer system in general. The supportive evidence of a relatively short flush-out time for the bedrock aquifer system is that petroleum hydrocarbons reported to be present in several wells in 1970 were not detected in the samples collected from the same wells in 1976.

Through the use of the Piper and Schoeller diagrams and maps showing the distribution of various chemical constituents, it has been demonstrated that the contaminants originate from three sources: (1) landfill leachate, (2) road salting and (3) septic tank effluent. A relatively small amount of nutrients originating from septic tank effluent spreading on the land may also be entering the bedrock aquifer system.

It is our opinion that Section 17 of the Ontario Environmental Protection Act, 1971 and Sections 31 and 32 of the Ontario Water Resources Act, 1970 have been violated.

The presence of the Denby sanitary landfill site poses a further threat to other domestic wells in the area because the pollution front is expected to continue to spread and to adversely affect additional domestic water supplies. The continuation of salt application to the road during the winter months will continue to elevate chloride and sodium levels in domestic wells particularly during the late spring and early summer.

CHAPTER 6

ALTERNATE SOURCES OF WATER SUPPLY

There are several alternatives available to restore affected water supplies. These include:

1. Reverse osmosis equipment could be installed to treat drinking and cooking water supplies. However this would be an expensive alternative and it may not guarantee the total removal of phenols.

2. Water could be hauled to the residences. However, this alternative is not a permanent solution of the problem which will persist for several years to come.

3. Suitable water supplies for domestic purposes could be obtained from a deeper bedrock aquifer. In this case, wells may yield water having a strong hydrogen sulphide odour, but otherwise water would be of suitable quality for domestic use. The hydrogen sulphide could be removed by appropriate treatment. A special well construction technique and procedure would be required if this alternative is pursued in order to shut out the shallow polluted water. The extent of a deeper bedrock aquifer in this area is not known, however.

4. A communal bedrock well could be constructed. The well should be located in an area where: (a) the bedrock aquifer is unaffected from the quality point of view, (b) the bedrock aquifer is protected by at least 20 feet (6 m) of overlying clayey material, (c) the pollution potential is minimal and (d) a sufficient elevation is

present so that gravitational feed is possible. The area southeast of the Dorland Subdivision would meet all these requirements. Well yield and water quality should be supported by a pumping test and chemical analyses. The difficulties concerning maintenance and control in establishing a private water supply system might be solved by incorporating it into the existing water supply system serving the Dorland Subdivision.

5. Since the affected domestic water supplies are located on the outskirts of the City of Woodstock the extension of the water main into the area of affected residences is an alternative.

The alternatives for restoring affected domestic water supplies should be also weighed by both economical and time factors.

CHAPTER 7

RECOMMENDATIONS

It is recommended that the operator of the Denby sanitary landfill site terminate use of the present site. In order to lessen potential contamination of neighbouring domestic wells and of groundwater in general, it is recommended that efforts be directed to reducing the amount of leachate which the site generates. In this regard, a planted and compacted clay cover (instead of sand and gravel presently used) is recommended together with an appropriately contoured and finished grade and a planted vegetative cover. This will reduce infiltration into the landfilled wastes and the generation of leachate.

In order to minimize the amount of leachate entering the bedrock aquifer the existing leachate collection system should be improved and its operation better maintained.

Although there is no direct evidence that the spreading of the septic tank effluent on the land has affected water quality in any sampled well in the area, it is recommended that this practice be terminated. The land used for spreading is located in a hydrogeologically sensitive environment.

Salt application on highway 2 is used to provide winter safety to travellers. The reduction of salt use will improve water quality in wells located downslope from the highway, but on the other hand, it will pose a greater threat to those using the highway in the winter. Perhaps the residences whose water quality is affected by salt should not have been built there in the first place. Ontario Regulation 502/72

(Amendment to the Environmental Protection Act 1971) states that any road authority which uses any substances on a highway for the purpose of keeping the highway safe for traffic under conditions of snow or ice that is a contaminant is exempt from the Act.

It is recommended that the operator of the landfill site should make an effort to restore affected water supplies. To this end, it is also recommended that a qualified hydrogeologist be hired to deal with resolving the problem. Details and procedures of remedial measures to restore water supplies should be be worked out in close consultation with the technical staff of this Ministry.

Monitoring should be continued by the Ministry to determine whether groundwater quality is affected over larger areas with passage of time.

ACKNOWLEDGEMENTS

The initial investigation into this problem was carried out by Steve Check. His participation in the well sampling program and in gathering other information in the field continued after the author became involved in September, 1976. Capable assistance with data compilation and drafting was provided by Cindy Riediger and Tom Ervasti.

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APPENDIX A

SUMMARY OF WATER WELL RECORDS

Ministry of the Environment
Ontario

SUMMARY OF WATER WELL RECORDS

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

COUNTY: OXFORD TOWNSHIP(S): SOUTH-WEST OXFORD DATE COMPILED: 09/12/76 COMPILER: T. ERVASTI

WELL[1] NO.	LOCATION TWP.	LOT	CON.	ELEV. (FT.)	OWNER	DRILLER	DATE DRILLED	LENGTH OF CASING (FEET)	WELL DIA. (IN.)	WELL DEPTH (FT.)	WATER FOUND (FT.)	STATIC LEVEL (FT.)	PUMPING TEST DRAW-DOWN (FT.)	PUMPING TEST G.P.M.	PUMPING TEST HRS.	WATER TYPE	LOG AND REMARKS
2279	S.W.O.	GORE	B.F.	932	FRED VALE	D. McLEOD	19/09/60	20	04	35	30	24	0	05	02	FRESH	GRAVEL AND STONES 0-20 LIMESTONE ROCK 20-35
2276	S.W.O.	GORE	B.F.	920	A. RADFORD	D. McLEOD	23/09/60	23	04	38	38	25	0	05	02	FRESH	SAND 0-10 GRAVEL 10-23 LIMESTONE 23-38
2210	S.W.O.	1	B.F.	928	L. HIPO (present owner) K. LINDSAY	K. McLEOD	23/01/66	17	4 1/4	50	50	20	23	04	04	SULPHUR	CLAY 0-6 SAND 6-17 ROCK 17-50
2879	S.W.O.	1	B.F.	932	D. NANCE KIVELL R. Millard (present owner)	R. RANSOME	09/09/69	21	05	38	37	23	01	04	1 1/2	FRESH	DUG BY HAND 0-21 LIMESTONE 21-38
3680	S.W.O.	1	B.F.	932	J. ELLIOT	N. STEINMAN	07/06/73	23	05	32	30	22	01	015	2 1/2	FRESH	GRAVEL AND STONES 0-23 LIMESTONE 23-32
3069	S.W.O.	1	B.F.	937	F. NEILL	R. McLEOD	03/09/70	26	04	34	34	25	0	08	02	FRESH	TOPSOIL 0-2 BOULDERS & GRAVEL 2-20 GRAVEL & HARDPAN 20-26 LIMESTONE 26-34
2280	S.W.O.	1	B.F.	940	F. NEILL JIM'S TRAILER PARK	E. JOSH	25/04/46	30	4 5/8	45	45	20	0	03	02	SULPHUR	GRAVEL 0-15 HARD PAN 15-30 LIMESTONE 30-45
2206	S.W.O.	1	B.F.	932	A. YOUNG (present owner) C. GEE	A. GHENT	01/06/56	25	05	38	37	10	02	06	04	FRESH	GRAVEL 0-25 LIMESTONE 25-38
2208	S.W.O.	1	B.F.	930	A.E. SLATER	D. McLEOD	27/09/60	25	04	35	34	20	04	05	02	FRESH	GRAVEL & SAND 0-25 LIMESTONE 25-35

[1] LOCATION IS SHOWN IN FIGURE 1.

Ministry of the Environment
Ontario

SUMMARY OF WATER WELL RECORDS

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

COUNTY: OXFORD TOWNSHIP(S): SOUTH-WEST OXFORD DATE COMPILED: 09/12/76 COMPILER: T. ERVASTI

WELL[1] NO.	LOCATION TWP.	LOT	CON.	ELEV. (FT.)	OWNER	DRILLER	DATE DRILLED	LENGTH OF CASING (FEET)	WELL DIA. (IN.)	WELL DEPTH (FT.)	WATER FOUND (FT.)	STATIC LEVEL (FT.)	PUMPING TEST DRAW-DOWN (FT.)	PUMPING TEST G.P.M.	PUMPING TEST HRS.	WATER TYPE	LOG AND REMARKS
2275	S.W.O.	GORE	B.F.	960	WESTMOUNT HOTEL — N. DeLEON	S. REMICK	06/05/50	–	4 5/8	52	52	35	12	09	03	FRESH	GRAVEL & BOULDERS 0-47 ROCK 47-52
2278	S.W.O.	GORE	B.F.	947	G. RADFORD — J. RADFORD	N. STEINMAN	12/09/57	38	4 1/2	41	38	26	08	010	04	FRESH	GRAVEL & BOULDERS 0-38 LIMESTONE 38-41
3414	S.W.O.	GORE	B.F.	947	G. RADFORD — J. RADFORD	N. STEINMAN	11/04/72	37	05	40	40	23	01	020	02	FRESH	CLAY & STONES 0-19 GRAVEL 19-37 LIMESTONE 37-40
2202	S.W.O.	1	B.F.	935	J. LOWES Can-Tario (present Precast Ltd owner)	E. JOSH	16/05/50	33	04	42	42	18	–	03	01	FRESH	SAND & GRAVEL 0-33 ROCK 33-42
2200	S.W.O.	1	B.F.	950	E. DENBY	E. JOSH	26/09/46	32	04	48	47	20	–	03	02	FRESH	SAND 0-5 STONES & SAND 5-15 SAND 15-30 ROCK 30-48
2204	S.W.O.	1	B.F.	956	J. DENBY	E. JOSH	10/11/50	36	4 1/2	52	52	21	04	03	01	FRESH	GRAVEL & STONES 0-20 SAND 20-33 ROCK 33-52
3582	S.W.O.	1	B.F.	964	J. DENBY	N. STEINMAN	13/10/72	45	05	69	65	49	02	014	02	SULPHUR	BOULDERS & GRAVEL 0-35 CLAY & GRAVEL 35-45 LIMESTONE 45-69
2207	S.W.O.	1	B.F.	968	J. DENBY	N. STEINMAN	15/06/59	45	04	90	47/85	47	16	08	03	TRACE OF SULPHUR	OPEN PIT 0-5 BOULDER & GRAVEL 5-33 CLAY 33-45 LIMESTONE 45-90 PLUGGED AT 82'
2203	S.W.O.	1	B.F.	941	C. JEFFERIES	E. JOSH	03/11/50	33	4 1/4	53	52	22	03	03	01	FRESH	GRAVEL & STONES 0-20 SAND 20-40 ROCK 40-53
2211	S.W.O.	1	B.F.	945	J. HEASLIP	E. JOSH	18/09/67	32	4 1/4	40	40	30	05	06	03	FRESH	SAND & GRAVEL 0-30 LIMESTONE .. 30-40
2201	S.W.O.	1	B.F.	947	J. FRASER	E. JOSH	14/04/50	33	04	48	48	18	–	03	01	FRESH	SAND 0-33 ROCK 33-48

[1] LOCATION IS SHOWN IN FIGURE 1.

Ministry of the Environment
Ontario

SUMMARY OF WATER WELL RECORDS

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

COUNTY: OXFORD TOWNSHIP(S): SOUTH-WEST OXFORD DATE COMPILED: 09/12/76 COMPILER: T. ERVASTI

WELL[1] NO.	LOCATION TWP.	LOT	CON.	ELEV. (FT.)	OWNER	DRILLER	DATE DRILLED	LENGTH OF CASING (FEET)	WELL DIA. (IN.)	WELL DEPTH (FT.)	WATER FOUND (FT.)	STATIC LEVEL (FT.)	PUMPING TEST DRAW-DOWN (FT.)	PUMPING TEST G.P.M.	PUMPING TEST HRS.	WATER TYPE	LOG AND REMARKS
2277	S.W.O.	1	B.F.	942	L. RIED P. KNOPP J. Streefkerk (present owner)	K. McLEOD	30/03/54	33	4¼	49	48	24	01	06	03	FRESH	TOP SOIL 0-2 HARDPAN & STONES 2-10 GRAVEL & STONES 10-33 LIMESTONE 33-49
2220	S.W.O.	1	B.F.	943	F. NISON W. HARTLEY (present owner)	A. GHENT	28/03/56	28½	5	50	49	22	02	06	03	FRESH	CLAY BOULDERS & SAND 0-28 LIMESTONE 28-50
2205	S.W.O.	1	B.F.	946	B. CHALMERS	E. JOSH	05/12/50	34	4¼	63	62	20	05	03	01	FRESH	GRAVEL & STONES 0-20 GRAVEL 20-34 ROCK 34-62
2213	S.W.O.	2	B.F.	945	V. LOWES S. BRUCE (present owner)	S. REMICK	08/06/49	—	4⅝	60	60	26	04	05	03	FRESH	GRAVEL 0-36 LIMESTONE 36-60
2217	S.W.O.	2	B.F.	946	F. KENNY	E. JOSH	03/12/51	35	04	55	55	18	07	03	01	FRESH	STONES & GRAVEL 0-10 SAND 10-35 ROCK 35-55
2214	S.W.O.	2	B.F.	990	J. DORLAND	E. JOSH	30/05/47	96	05	124	124	66	—	03	02	FRESH	GRAVEL 0-26 CLAY 26-50 SAND 50-70 HARDPAN 70-96 ROCK 96-124
2221	S.W.O.	2	B.F.	990	DORLAND SUBDIVISION	K. McLEOD	17/03/60	94	5½	135	125	60	25	020	01	FRESH	CLAY 0-20 HARDPAN & STONES 20-94 LIMESTONE 94-135
4002	S.W.O.	1	I	1205	H. KARN	N. STEINMAN	05/08/74	306	05	366	340	223	57	012	2½	FRESH	CLAY 0-84 GRAVEL 84-96 HARDPAN 96-219 CLAY 219-286 HARDPAN 286-297 SHALE 297-306 LIMESTONE 306-366
1	S.W.O.	GORE	B.F.	929	B. BERTRAND B. CRYNEN (present owner)												Well terminated in bedrock (no well record)
2	S.W.O.	GORE	B.F.	931	A. DeZUTTER												Bedrock well
3	S.W.O.	GORE	B.F.	932	D. HARBURN												" "

[1] LOCATION IS SHOWN IN FIGURE 1.

Ministry of the Environment
Ontario

SUMMARY OF WATER WELL RECORDS

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

COUNTY: OXFORD TOWNSHIP(S): SOUTH-WEST OXFORD DATE COMPILED: 20/1/77 COMPILER: C. RIEDIGER

WELL NO.[1]	LOCATION TWP.	LOT	CON.	ELEV. (FT.)	OWNER	DRILLER	DATE DRILLED	Length of casing (ft)	WELL DIA. (IN.)	WELL DEPTH (FT.)	WATER FOUND (FT.)	STATIC LEVEL (FT.)	PUMPING TEST DRAW-DOWN (FT.)	PUMPING TEST G.P.M.	PUMPING TEST HRS.	WATER TYPE	LOG AND REMARKS
4	S.W.O.	GORE	B.F.	928	E. ENTRONMENT G. MATERN D. HARMER (present owner)				5	22.7							Bedrock well
5	S.W.O.	1	B.F.	933	M.E. ELLIOT				4	27.8							" "
6	S.W.O.	GORE	B.F.	948	H. ROBILLARD												" "
7	S.W.O.	GORE	B.F.	947	J. BOWMAN												" "
8	S.W.O.	GORE	B.F.	944	T. McGINNIS												" "
9	S.W.O.	GORE	B.F.	949	F. TILLEY												" "
10	S.W.O.	GORE	B.F.	944	J. HIBNER												" "
11	S.W.O.	1	B.F.	942	G. BLAIS												" "
12	S.W.O.	1	B.F.	949	K. ELLERY					55							" "
13	S.W.O.	1	B.F.	947	E. KEATINGS												" "
14	S.W.O.	1	B.F.	945	E. SEAGRIST												" "

[1] Location is shown in Figure 1

Ministry of the Environment
Ontario

SUMMARY OF WATER WELL RECORDS

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

COUNTY: OXFORD TOWNSHIP(S): SOUTH-WEST OXFORD DATE COMPILED: 20/1/77 COMPILER: C. RIEDIGER

WELL NO.[1]	LOCATION			ELEV. (FT.)	OWNER	DRILLER	DATE DRILLED	Length of casing (ft)	WELL DIA. (IN.)	WELL DEPTH (FT.)	WATER FOUND (FT.)	STATIC LEVEL (FT.)	PUMPING TEST			WATER TYPE	LOG AND REMARKS
	TWP.	LOT	CON.										DRAW-DOWN (FT.)	G.P.M.	HRS.		
15	S.W.O.	1	B.F.	945	J. FEATHERSTONE												Bedrock well
16	S.W.O.	1	B.F.	946	R. GUNN												" "
17	S.W.O.	2	B.F.	986	J. WATLING												" "
18	S.W.O.	2	B.F.	1010	J. STANSFIELD												" "
3092	S.W.O.	2	B.F.	1185	D. KARN	N. STEINMAN	05/10/70	248	07	281	278	156	26	17	3	FRESH	BROWN STONEY CLAY 0-23 CLAYEY GRAVEL 23-145 GREY GRITTY CLAY 145-205 GREY CLAY 205-248 GREYISH-BROWN LIMESTONE 248-281

[1] Location is shown in Figure 1

APPENDIX B

SUMMARY OF CHEMICAL ANALYSES OF GROUNDWATER

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVAST! AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
1	B. Bertrand B Crynen (present owner)	GORE	B.F.	21/06/76	ppm	380	313		7.48					290	1.5	420	48								<1	0.10
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2	A. DeZutter	GORE	B.F.	15/06/76	ppm	308	254	600	7.45							14.0	38								<1	0.06
					epm																					
					%epm																					
"	"	"	"	21/06/76	ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
3	D. Harburn	GORE	B.F.	14/12/70	ppm	420	250		7.4			123	27	41	1.4	142	32	3048	0.01	0.10	0.003	5.5			3	0.10
					epm							6.138	2.221	1.783	0.036	4.005	0.666	4.995				0.393				
					%epm							60.3	21.82	17.52	0.35	41.43	6.89	51.67								
"	"	"	"	26/05/76	ppm	260	254	600	7.78								42			0.370			0.006		2	0.07
					epm																					
					%epm																					
"	"	"	"	15/06/76	ppm	292	248	560	7.6							7.5	34.5								<1	0.07
					epm																					
					%epm																					
"	"	"	"	21/06/76	ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C.RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand ; 5-Day	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic Detergent A.B.S.	Total Dissolved Solids
1	B. Bertrand B. Crynen (present owner)	GORE	B.F.	21/06/76		0.16	<0.01		<0.02				<0.02		39	78	6	84	N.D.			1156
2	A. DeZutter	GORE	B.F.	15/06/76									<0.02		10	65	1	66	N.D.			370
"	"	"	"	21/06/76		0.53	0.05		<0.02													
3	D. Harburn	GORE	B.F.	14/12/70																	0.1	
"	"	"	"	26/05/76										0.4	<2.0						<0.1	
"	"	"	"	15/06/76									<0.02		4	63	2	65	N.D.			336
"	"	"	"	21/06/76		0.30	0.02		<0.02													

[1] Location is shown in Figure 1 ; N.D. – Not detected; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
4	E. Entronment	GORE	B.F.	07/07/70	ppm							138	15	104	10.3		41									
					epm																					
					%epm																					
"	G. Matern	"	"	14/12/70	ppm	524	395		7.1			180	18.0	190	6.8	336	51	481.6	0.01	0.27	0.002	6.5			4	0.2
					epm							8.982	1.480	8.265	0.173	9.478	1.061	7.893				0.464				
					%epm							47.52	7.83	43.73	0.91	51.42	5.75	42.82								
"	"	"	"	21/06/76	ppm	392	381		7.24					84	16.2	54	48								<1	0.01
					epm																					
					%epm																					
"	"	"	"	04/10/76	ppm	388	376	1010	7.47	<5	0.30	125	18.8	55	17.2	56	46	458.42	0.015	0.245	0.001	8.0	0.009	0.008	<1	0.01
					epm							6.238	1.546	2.392	0.439	1.579	0.958	7.513				0.57				
					%epm							58.77	14.56	22.53	4.14	15.71	9.53	74.75								
"	D. Harmer (present owner)	"	"	23/11/76	ppm	430	377	1100	7.48	<5	0.30	140	18.4	59.5	9.8	90	39.0	459.6	0.005	0.20	<0.001	6.9	0.011	0.004	1	0.02
					epm							6.986	1.514	2.588	0.251	2.539	0.812	7.533				0.493				
					%epm							61.61	13.35	22.82	2.21	23.33	7.46	69.21								
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2276	A. Radford	GORE	B.F.	21/06/76	ppm	424	410		7.21					230	9.8	280	53								<1	0.02
					epm																					
					%epm																					

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic Detergent A.B.S.	Total Dissolved Solids
4	E. Entronment	GORE	B.F.	07/07/76															N.D.			
"	G. Matern	"	"	14/12/76																	0.1	
"	"	"	"	21/06/76		0.08	0.07		<0.02				<0.02		9.7	112	4	116	N.D.			682
"	"	"	"	04/10/76											3.9							550
"	D. Harner (present owner)	"	"	28/11/76																		
2276	A. Radford	GORE	B.F.	21/06/76		0.27	0.50		<0.02				< 0.02		47	120	4	124	N.D.			1064

[1] Location is shown in Figure 1 ; N.D. – Not detected; < -Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 12/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
					ppm																					
					epm																					
					%epm																					
2210	R.J. Carew	1	B.F	07/07/70	ppm							59	28	19	1.7		48									
					epm																					
					%epm																					
"	"	"	"	30/09/70	ppm	268	257		7.5							3			<0.01	0.13	0.001	0.01			4	0.2
					epm																					
					%epm																					
"	K. Lindsay (present owner)	"	"	21/06/76	ppm	564	491		7.2					245	1.9	335	86								<1	0.36
					epm																					
					%epm																					
"	"	"	"	04/10/76	ppm	292	277	630	7.46	5	2.7	71.0	29.0	28.4	1.4	14.5	50	337.1	0.055	0.185	0.001	0.05	0.045	0.03	<1	0.3
					epm							3.542	2.385	1.235	0.035	0.409	1.041	5.535				0.004				
					%epm							49.21	33.14	17.16	0.49	5.85	14.90	79.24								
"	"	"	"	15/11/76	ppm	260	250		7.56					20.0	1.4	4.5	48								<1	0.27
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2210	R.J. Carew	1	B.F.	07/07/70															N.D.			
"	"	"	"	29/09/70																		
"	K. LINDSAY (present owner)	"	"	21/06/76		0.34	0.10		<0.02				<0.02		23	140	4	144	N.D.	0		1310
"	"	"	"	04/10/76											2.0	68	5	73		0		328
"	"	"	"	15/11/76											<1.9							

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
2879	D. Nancekivell	1	BF	07/07/70	ppm							173	27	121	2.5		58		0.01	0.08	0.39	15.0	0.037		20	
					epm																					
					%epm																					
"	"	"	"	30/09/70	ppm	540	427		7.0							233			0.07	0.24	0.44	4.6			5	0.2
					epm																					
					%epm																					
"	R. Millard	"	"	26/05/76	ppm	1000	491	4350	7.13								180		0.005	0.355	0.033		0.007		2	0.11
					epm																					
					%epm																					
"	"	"	"	23/06/76	ppm																					
					epm																					
					%epm																					
"	"	"	"	04/10/76	ppm	556	473	2040	7.40	<5	0.40	212	25.2	216	2.3	310	112	576.69	0.015	0.295	0.035	7.4	0.010	0.007	1	0.03
					epm							10.579	2.073	9.396	0.059	8.745	2.332	9.452				0.529				
					%epm							47.85	9.38	42.50	0.27	42.60	11.36	46.04								
"	"	"	"	15/11/76	ppm	516	419		7.07					128	2.1	203	96								1	<0.01
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe
2879	D. Nancekivell	1	BF	07/07/76	ppm							173	27	121	2.5		58		0.01	0.08	0.39	15.0	0.037		20	
					epm																					
					%epm																					
"	"	"	"	30/09/76	ppm	540	427		7.0							233			0.07	0.24	0.44	4.6			5	0.2
					epm																					
					%epm																					
"	R. Millard	"	"	26/05/76	ppm	1000	491	4350	7.13								180		0.005	0.355	0.033		0.007		2	0.11
					epm																					
					%epm																					
"	"	"	"	23/06/76	ppm																					
					epm																					
					%epm																					
"	"	"	"	04/10/76	ppm	556	473	2040	7.40	<5	0.40	212	25.2	216	2.3	310	112	576.69	0.015	0.295	0.035	7.4	0.010	0.007	1	0.03
					epm							10.579	2.073	9.396	0.059	8.745	2.332	9.452				0.529				
					%epm							47.85	9.38	42.50	0.27	42.60	11.36	46.04								
"	"	"	"	15/11/76	ppm	516	419		7.07					128	2.1	203	96								1	<0.01
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand; 5-Day	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2879	D. Nancekivell	1	B.F.	07/07/70															24		0.04	
"	"	"	"	30/09/70																		
"	R. Millard	"	"	26/05/76										0.4	46						<0.1	2888
"	"	"	"	23/06/76		0.05	0.10		<0.01													
"	"	"	"	04/10/76											69	132	10	142		0		1120
"	"	"	"	15/11/76											54							

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
3680	J. Elliot	1	B.F	30/09/76	ppm	408	308	1180	7.48	<5	0.50	122	22.8	88	1.8	125	76	375.52	0.005	0.105	0.007	8.1	0.009	0.009	1	<0.01
					epm							6.087	1.875	3.828	0.046	3.53	1.582	6.155				0.579				
					%epm							51.42	15.84	32.34	0.38	31.30	14.04	54.41								
"	"	"	"	15/11/76	ppm	304	348		7.14					80	1.9	125	80								<1	<0.01
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
5	M. Elliot	1	B.F	04/03/69	ppm																				4	
					epm																					
					%epm																					
"	"	"	"	07/07/70	ppm							125	24	74	1.6		66		0.01	0.18	0.21	2.4	0.049		12	
					epm																					
					%epm																					
"	"	"	"	30/09/70	ppm	460	367		7.3							140			0.12	0.39	0.15	1.5			13	0.15
					epm																					
					%epm																					
"	"	"	"	30/09/76	ppm	388	305	850	7.31	<5	0.30	115	23.8	27.0	1.1	42	64	371.86	0.005	0.155	0.001	5.6	0.019	0.012	<1	<0.01
					epm							5.738	1.957	1.174	0.028	1.184	1.332	6.094				0.40				
					%epm							64.49	21.99	13.19	0.31	13.75	15.47	70.77								

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic Detergent A.B.S.	Total Dissolved Solids
3680	J. Elliot	1	B.F.	30/09/76											31	90	7	97		0		730
"	"	"	"	23/11/76											29							
5	M. Elliot	1	B.F.	04/03/69																		
"	"	"	"	07/07/70															38		0.06	
"	"	"	"	30/09/70																		
"	"	"	"	30/09/76											17	88	8	96		0		550

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
5	M. Elliot	1	BF	04/10/76	ppm																					
					epm																					
					%epm																					
"	"	"	"	15/11/76	ppm	384	321		7.18					24.6	2.5	35.0	64								<1	<0.01
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
3069	F. Neill	1	BF	30/09/70	ppm	440	337		7.3			136	24	195	2.7	319	35	410.8	<0.01	0.12	0.011	16.0			3	0.30
					epm							6.786	1.974	8.482	0.069	8.998	0.728	6.734				0.786				
					%epm							39.36	11.45	49.19	0.40	54.66	4.42	40.91								
"	"	"	"	22/06/76	ppm																					
					epm																					
					%epm																					
"	"	"	"	30/09/76	ppm	336	312	900	7.46	<5	0.40	102.5	19.2	60	2.9	56	55	380.4	0.005	0.145	0.001	6.7	0.010	0.005	1	0.01
					epm							5.114	1.579	2.610	0.074	1.579	1.145	6.234				0.479				
					%epm							54.53	16.83	27.83	0.78	17.62	12.70	69.59								
"	"	"	"	15/11/76	ppm	240	284		7.29					56.5	3.0	64	53								<1	<0.01
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic Detergent A.B.S.	Total Dissolved Solids
5	M. Elliot	1	B.F.	04/10/76															N.D.			
"	"	"	"	15/11/76											14							
3069	F. Neill	1	B.F.	30/09/76																		
"	"	"	"	22/06/76		0.39	0.02		0.02							80	1	81	N.D.			
"	"	"	"	30/09/76											18	85	8	93		0		548
"	"	"	"	15/11/76											9.6							

[1] Location is shown in Figure 1 ; N.D. – Not detected; < -Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Iron Fe
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2280	Jim's Trailer Park	1	BF	21/05/76	ppm	396		760				100	27.0				26.0		0.005	0.575	<0.001	<0.01			1	0.88
					epm																					
					%epm																					
"	"	"	"	26/05/76	ppm	380	368	750	7.70								14.0								1	1.17
					epm																					
					%epm																					
"	"	"	"	22/06/76	ppm	388	320	740	7.49					20.2	1.4	20.5	60								<1	0.86
					epm																					
					%epm																					
"	"	"	"	30/09/76	ppm	328	296	670	7.53	10	27	86.0	27.6	20.0	0.5	13.5	58	360.89	0.050	0.225	<0.001	<0.01	0.017	0.002	<1	0.60
					epm							4.291	2.270	0.870	0.012	0.380	1.208	5.915								
					%epm							57.65	30.50	11.69	0.16	5.07	16.1	78.84								
"	"	"	"	23/11/76	ppm	328	290	670	7.58	15	33	82.5	26.4	17.6	1.3	12.5	64	353.51	0.06	0.185	<0.001	<0.01	0.009	0.002	1	0.92
					epm							4.11	2.17	0.76	0.03	0.35	1.33	5.80								
					%epm							58.13	30.69	10.74	0.42	4.69	17.82	77.47								
					ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand ; 5-Day	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2280	JIM'S TRAILER PARK	1	BF.	21/05/76								17		10.8	105						0.1	458
"	"	"	"	26/05/76										6.1	78						0.2	
"	"	"	"	22/06/76		0.03	<0.01		<0.01				0.51		17	82	2	84	N.D.			452
"	"	"	"	30/09/76											9.2	78	6	84		0		412
"	"	"	"	23/11/76																		

[1]Location is shown in Figure 1 ; N.D. – Not detected; < -Refers to less than ; 1 ppm=1 mg/l=1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2206	C. Gee	1	BF.	22/06/76	ppm	8	366	860	7.27					206	0.4	26	38.5								<1	0.09
					epm																					
					%epm																					
"	"	"	"	30/09/76	ppm	424	375	880	7.34	<5	0.55	102.5	41.4	22.4	1.5	29.5	39.0	457.21	0.025	0.295	0.011	5.8	0.003	0.003	1	<0.01
					epm							5.114	3.405	0.974	0.038	0.832	0.811	7.493				0.414				
					%epm							53.66	35.73	10.22	0.40	9.10	8.87	82.01								
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2208	A.E. Slater	1	BF	14/12/70	ppm	564	280		7.6			106	72	8	0.9	21	45	341.38	0.02	0.18	0.001	6.5			4	trace
					epm							5.289	5.922	0.348	0.023	0.592	0.936	5.595				0.464				
					%epm							45.66	51.13	3.00	0.19	8.31	13.14	78.54								
"	"	"	"	22/06/76	ppm	352	276	660	7.68					8.2	0.9	7.0	48								<1	0.05
					epm																					
					%epm																					

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2206	C. Gee	1	B.F.	22/06/76		<0.01	0.02		<0.01				<0.02		16	92	2	94	N.D.			532
"	"	"	"	30/09/76											22	102	12	114		0		552
2208	A.E. Slater	1	B.F.	14/12/70																	0.1	
"	"	"	"	22/06/76		0.30	0.02		<0.01				<0.02		7.7	71	1	72	N.D.			432

[1] Location is shown in Figure 1 ; N.D. – Not detected; < -Refers to less than ; 1 ppm=1 mg/l=1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
2208	A.E. Slater	1	BF.	30/09/76	ppm	360	292	690	7.61	<5	0.50	104.5	24.0	7.5	0.8	8.5	54	356.01	0.005	0.110	0.001	4.1	0.005	0.004	<1	0.01
					epm							5.214	1.974	0.326	0.020	0.239	1.124	5.835				0.293				
					%epm							69.20	26.20	4.32	0.26	3.32	15.61	81.06								
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
6	H. Robillard	GORE	BF.	14/06/76	ppm	328	261	640	7.54					10.4	1.8	14.0	46								<1	0.05
					epm																					
					%epm																					
11	11	11	11	21/06/76	ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2275	Westmount Motel N. DeLeon	GORE	BF.	14/06/76	ppm	6	236	465	7.78					119	0.3	3.0	15.0								<1	1.14
					epm																					
					%epm																					
11	Westmount Motel F. Karn (present owner)	11	11	21/06/76	ppm																					
					epm																					
					%epm																					

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2208	A.E. Slater	1	B.F.	30/09/76											18	77	4	81		0		460
6	H. Robillard	GORE	B.F.	14/06/76									<0.02		6	67	1	68	N.D.			406
"	"	"	"	21/06/76		0.08	0.02		<0.02													
2275	Westmount Motel N. DeLeon	GORE	B.F.	14/06/76									<0.02		4	58	2	60	N.D.			288
"	Westmount Motel F. Karn (present owner)	"	"	21/06/76		0.14	<0.01		<0.02													

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
					ppm																					
					epm																					
					%epm																					
7	J. Bowman	GORE	B.F.	22/06/76	ppm	222	235	467	7.74					17.3	0.9	2.0	16.0								<1	0.10
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2278 3414	J. Radford	GORE	B.F.	14/06/76	ppm	308	240	560	7.65					2.9	0.6	4.5	32.0								<1	0.07
					epm																					
					%epm																					
"	"	"	"	21/06/76	ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
8	T. McGinnis	GORE	B.F.	21/06/76	ppm	278	239		7.54					2.2	0.6	15	28.0								<1	0.11
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
9	F. Tilley	GORE	B.F.	14/06/76	ppm	292	252	550	7.63					6.3	0.8	4	40								<1.	0.15
					epm																					
					%epm																					

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
7	J. Bowman	GORE	B.F.	22/06/76		0.06	0.02		<0.01				<0.02		7.8	60	1	61	N.D.			254
2278 3414	J. Radford	GORE	B.F.	14/06/76									<0.02		2	59	1	60	N.D.			380
"	"	"	"	21/06/76		0.07	0.06		0.04													
8	T. McGinnis	GORE	B.F.	21/06/76		0.47	0.02		<0.02				<0.02		<2.0	64	1	65	N.D.			348
9	F. Tilley	GORE	B.F.	14/06/76									<0.02		4	61	1	62	N.D.			356

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIGDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
9	F. Tilley	GORE	B.F.	21/06/76	ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
10	J. Hibner	GORE	B.F.	14/06/76	ppm	348	277	630	7.46					4.8	2.8	6.5	48								<1	0.10
					epm																					
					%epm																					
"	"	"	"	21/06/76	ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2202	Lowes TRANSPORT	1	BF.	07/07/70	ppm	268	289		7.5			70	22	32	4.0	27	18	352.35								0.3
					epm							3.493	1.810	1.392	0.102	0.762	0.375	5.775								
					%epm							51.39	26.61	20.48	1.50	11.01	5.41	83.57								
"	"	1	BF.	30/09/70	ppm	272	255		7.4							6			0.02	0.16	0.002	1.2			0	0.15
					epm																					
					%epm																					
"	Con-Tario Precast Ltd.	1	B.F.	14/06/76	ppm	424	291	940	7.33					42	1.7	65	88								<1	0.31
					epm																					
					%epm																					
"	"	1	B.F.	21/06/76	ppm																					
					epm																					
					%epm																					

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
9	F. Tilley	GORE	B.F.	21/06/76		0.32	<0.01		<0.02													
10	J. Hibner	GORE	B.F.	14/06/76									<0.02		4	73	1	74	N.D.			416
"	"	"	"	21/06/76		0.19	0.02		<0.02													
2202	Lowes Transport	1	B.F.	07/07/70															10			
"	"	"	"	30/09/70																		
"	Can-Tario Precast Ltd.	"	"	14/06/76									<0.02		15	79	1	80	N.D.			622
"	"	"	"	21/06/76		0.48	0.56		<0.02													

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
2202	Can-Tario Precast Ltd.	1	BF	23/11/76	ppm	274	256	580	7.61	<5	0.45	75.2	19.4	15.4	2.4	8.5	43	312.12	0.055	0.26	0.031	0.50	0.007	0.006	1	0.74
					epm							3.752	1.596	0.670	0.061	0.240	0.895	5.116				0.036				
					%epm							61.72	26.25	11.02	1.00	3.84	14.32	81.84								
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
11	G Blais	1	BF	14/06/76	ppm	404	288	840	7.39					23.0	1.5	25.5	72								<1	0.11
					epm																					
					%epm																					
"	"	"	"	21/06/76	ppm																					
					epm																					
					%epm																					
"	"	"	"	30/09/76	ppm	360	269	690	7.65	<5	0.5	95.0	24.2	13.4	1.1	11.5	66	327.97	0.005	0.135	<0.001	5.1	0.005	0.003	<1	0.03
					epm							4.741	1.991	0.583	0.028	0.324	1.374	5.375				0.364				
					%epm							64.56	27.11	7.94	0.38	4.58	19.42	75.99								
"	"	"	"	15/11/76	ppm	302	256		7.35					10.4	1.0	8.0	63								<1	<0.01
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2202	Can-tario Precast Ltd.	1	B.F.	23/11/76																		
11	G. Blais	1	B.F.	14/06/76									<0.02		11	73	1	74	N.D.			592
"	"	"	"	21/06/76		0.35	0.03		<0.02													
"	"	"	"	30/09/76											18	73	4	77		0		466
"	"	"	"	15/11/76											7.7							

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2200	E. Denby	I	BF	30/09/76	ppm	280	246		7.5			78	20	5	0.7	6	37	299.83	<0.01	0.11	0.002	1.1			3	trace
					epm							3.892	1.645	0.218	0.018	0.169	0.770	4.916				0.079				
					%epm							67.42	28.49	3.76	0.30	2.89	13.15	83.96								
2200	E. Denby (A. Drysdale residence)	II	II	26/05/76	ppm	444	302	930	7.52							33.5	75			0.585			0.005		2	0.11
					epm																					
					%epm																					
II	II	II	II	15/06/76	ppm	416	287	840	7.36							24.5	68								<1	0.05
					epm																					
					%epm																					
II	II	II	II	21/06/76	ppm																					
					epm																					
					%epm																					
II	II	II	II	30/09/76	ppm	340	270	680	7.44	<5	0.90	97.5	24.4	13.8	0.4	11.0	62	329.19	0.005	0.130	0.001	4.9	0.017	0.006	1	0.6
					epm							4.865	2.007	0.600	0.010	0.310	1.291	5.395				0.35				
					%epm							65.02	26.82	8.01	0.13	4.43	18.45	77.12								
II	II	II	II	15/11/76	ppm	272	260		7.38					10.7	1.0	8.0	62								2	0.02
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand; 5-Day	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2200	E. Denby	1	B.F.	30/09/76																		
2200	E. Denby (A. Dryscale residence)	"	"	26/05/76										0.3	28						<0.1	
"	"	"	"	15/06/76									0.23		12	74	1	75	N.D.			566
"	"	"	"	21/06/76		0.70	<0.01		<0.02													
"	"	"	"	30/09/76											1.8	71	5	76		0		448
"	"	"	"	15/11/76											3.9							

[1] Location is shown in Figure 1 ; N.D. — Not detected; < -Refers to less than; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2204	E. Denby	1	B.F.	30/09/76	ppm	390	315		7.7			114	25	11	2.3	13	49	384.05	0.01	0.17	0.002	5.5			0	0.05
					epm							5.689	2.057	0.479	0.059	0.367	1.020	6.295				0.393				
					%epm							68.67	24.83	5.78	0.71	4.78	13.28	81.94								
					ppm																					
					epm																					
					%epm																					
2207(a)	J. Denby	1	B.F.	30/09/76	ppm	260	260		7.6			54	30	20	1.6	3	39	317.00	0.13	0.30	0.002	0.01			5	0.10
					epm							2.695	2.468	0.87	0.041	0.085	0.812	5.195								
					%epm							44.37	40.63	14.32	0.68	1.40	13.33	85.26								
2207(b)	" DUPLICATE	"	"	30/09/76	ppm	260	258		7.5			54	30	20	1.5	4	38	314.56	0.12	0.28	0.002	0.02			12	0.15
					epm							2.695	2.468	0.87	0.038	0.113	0.791	5.156								
					%epm							44.4	40.7	14.3	0.6	1.86	13.05	85.08								
3582	J. Denby	1	B.F.	21/04/76	ppm	364	344	716	7.72			80	35.2	20.0	1.2	17.5	11.5	418.41	<0.005	0.680	0.001	0.08				1.26
					epm							3.992	2.896	0.87	0.031	0.494	0.239	6.874								
					%epm							51.25	37.18	11.17	0.40	6.49	3.14	90.36								
"	"	"	"	12/05/76	ppm	340	338	660	7.63							14.5			0.135	0.725	0.001		0.040	0.004	<1	0.39
					epm																					
					%epm																					
"	"	"	"	26/05/76	ppm	328	340	650	7.73							14.5	10.0		0.125	0.325	0.001	<0.01	0.031		2	0.27
					epm																					
					%epm																					

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVAST1 AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand ; 5-Day	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2204	E. Denby	1	B.F.	30/09/70																		
2207	J. Denby	1	B.F.	30/09/70																		
"	" DUPLICATE	"	"	30/09/70																		
3582	J. Denby	1	B.F.	21/04/76										>14.4								466
"	"	"	"	12/05/76								3		8.2	41							
"	"	"	"	26/05/76										3.2	18						<0.1	398

[1]Location is shown in Figure 1 ; N.D. – Not detected; < -Refers to less than ; 1 ppm=1 mg/l=1 lb/100,000 Imp. gal.; > – Refers to greater than

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
3582	J. Denby	1	BF	15/06/76	ppm	300	293	600	7.57							9.0	21.0								1	0.46
					epm																					
					%epm																					
"	"	"	"	21/06/76	ppm																					
					epm																					
					%epm																					
"	" (RAW)	"	"	30/09/76	ppm	300	287	600	7.58	10	4.7	65.5	33.0	18.0	1.3	7.5	36.0	349.91	0.285	0.475	0.001	<0.01	0.023	0.006	1	0.6
					epm							3.268	2.715	0.783	0.033	0.212	0.750	5.735								
					%epm							48.07	39.93	11.52	0.49	3.17	11.20	85.64								
"	" (TREATED)	"	"	30/09/76	ppm	<2	279	820	7.38	<5	0.40	1.8	0.8	185	0.8	72	33.0	340.16	0.010	0.100	0.001	<0.01	0.007	0.001	<1	0.12
					epm							0.090	0.066	8.048	0.020	2.031	0.687	5.575								
					%epm							1.09	0.80	97.86	0.24	24.49	8.28	67.23								
"	"	"	"	23/11/76	ppm	288	282	590	7.61	20	23	60.5	29.6	18.2	1.3	8.5	37.0	343.82	0.32	0.460	0.001	<0.01	0.033	0.004	1	2.4
					epm							3.019	2.435	0.792	0.033	0.240	0.77	5.635								
					%epm							48.08	38.78	12.61	0.53	3.61	11.59	84.80								
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
12	K. Ellery	1	BF	30/09/76	ppm	336	270		7.4			101	20	10	1.3	11	56	329.20	<0.01	0.12	0.002	5.5			0	0.05
					epm							5.040	1.645	0.435	0.033	0.310	1.166	5.396				0.393				
					%epm							70.46	23.00	6.08	0.46	4.51	16.97	78.54								

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C.RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
3582	J. Denby	1	BF	15/06/76									<0.02		14	76	1	77	N.D.			368
"	"	"	"	21/06/76		0.02	<0.01		<0.02													
"	" (RAW)	"	"	30/09/76											7.3	82	6	88		0.5		366
"	" (TREATED)	"	"	30/09/76											28							498
"	"	"	"	23/11/76									0.22									
12	K. Ellery	1	BF	30/09/76																		

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVAST1 AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
12	K. Ellery	1	BF.	21/04/76	ppm	464	408	880	7.75			124	31.0	20.0	1.2	37.0	26.5	497.44	<0.005	1.30	<0.001	<0.01				3.30
					epm							6.188	2.550	0.870	0.031	1.044	0.552	8.153								
					%epm							64.20	26.46	9.03	0.32	10.71	5.66	83.63								
"	"	"	"	12/05/76	ppm	76	436	940	7.5										<0.005		<0.001	<0.01	0.030	<0.001	35	0.82
					epm																					
					%epm																					
"	"	"	"	21/05/76	ppm	476		920				76	30				2.5		0.010		<0.001	<0.01			47	28
					epm																					
					%epm																					
"	"	"	"	26/05/76	ppm	464	439	920	7.72							42	3.5		<0.005	0.075	<0.001	<0.01	0.025		49	4.40
					epm																					
					%epm																					
"	"	"	"	15/06/76	ppm	448	442	880	7.49							36.5	0.5								45	3.80
					epm																					
					%epm																					
"	"	"	"	22/06/76	ppm																					
					epm																					
					%epm																					
"	"	"	"	30/09/76	ppm	408	393	810	7.35	25	32	112.5	29.6	36.0	0.8	31.5	16.0	479.15	0.05	0.59	0.001	<0.01	0.066	0.001	2	2.70
					epm							5.614	2.435	1.566	0.020	0.889	0.333	7.853								
					%epm							58.26	25.26	16.25	0.20	9.78	3.66	86.54								
"	"	"	"	15/11/76	ppm	416	387		7.23					22.2	1.0	35.5	22.0								2	2.00
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

100

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand; 5-Day	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
12	K. Ellery	1	B.F.	21/04/76										61								562
11	11	11	11	12/05/76								9		75	239							
11	11	11	11	21/05/76								23		120	617						0.15	608
11	11	11	11	26/05/76										67	521						0.25	608
11	11	11	11	15/06/76									0.23		111	98	40	138	N.D.			548
11	11	11	11	22/06/76		0.13	0.06		<0.01													
11	11	11	11	30/09/76											24	110	14	124		0		478
11	11	11	11	15/11/76											19							

[1] Location is shown in Figure 1 ; N.D. – Not detected; < – Refers to less than; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
13	E. Keatings	1	BF	14/06/76	ppm	416	370	820	7.62					18.3	1.1	20.5	37.5								5	0.36
					epm																					
					%epm																					
"	"	"	"	30/09/76	ppm	428	377	860	7.31	10	6.3	120	31.4	19.0	1.1	25.0	39.5	459.64	0.035	0.35	0.007	4.9	0.028	0.002	1	2.10
					epm							5.988	2.583	0.827	0.028	0.705	0.822	7.533				0.350				
					%epm							63.53	27.40	8.77	0.30	7.78	9.07	83.15								
"	"	"	"	15/11/76	ppm	248	321		7.19					18.3	1.1	28.0	40								<1	0.76
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
14	E. Seagrist	1	BF	14/06/76	ppm	492	414	960	7.35					18.3	1.0	32.5	35.0								6	0.65
					epm																					
					%epm																					

[1] Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic Detergent A.B.S.	Total Dissolved Solids
13	E. Keatings	1	B.F.	14/06/76									<0.02		28				N.D.			546
"	"	"	"	30/09/76											17	98	0	98		0		544
"	"	"	"	15/11/76											14							
14	E. Seagrist	1	B.F.	14/06/76											34				N.D.			628

[1] Location is shown in Figure 1 ; N.D. – Not detected; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
14	E. Seagrist	1	BF	23/06/76	ppm																					
					epm																					
					%epm																					
11	11	11	11	30/09/76	ppm	428	376	840	7.39	5	4.4	120	30.0	16.0	0.9	24.0	38.0	458.12	0.005	0.265	0.010	3.3	0.009	0.002	1	0.56
					epm							5.988	2.468	0.696	0.023	0.677	0.791	7.514				0.236				
					%epm							65.26	26.90	7.59	0.25	7.54	8.81	83.66								
11	11	11	11	23/11/76	ppm	420	378	820	7.39	5	5.4	112	29.0	18.1	0.9	30.5	35.0	460.86	0.015	0.24	0.006	1.18	0.005	0.001	1	0.68
					epm							5.589	2.386	0.787	0.023	0.860	0.729	7.553				0.084				
					%epm							63.62	27.16	8.96	0.26	9.41	7.97	82.62								
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2203	C. Jefferies	1	BF	26/05/76	ppm	416	376	800	7.51							24.5	34.5		<0.005	0.110	0.011	0.16	0.012		3	1.60
					epm																					
					%epm																					
11	11	11	11	14/06/76	ppm	432	405	820	7.39					20.6	1.2	27.5	16.0								6	6.4
					epm																					
					%epm																					
11	11	11	11	22/06/76	ppm																					
					epm																					
					%epm																					

[1] Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand ; 5-Day	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic Detergent A.B.S.	Total Dissolved Solids
14	E. Seagrist	1	B.F.	23/06/76		4.2	0.04		<0.01													
"	"	"	"	30/09/76											29	112	8	120		0		522
"	"	"	"	23/11/76									<0.02									
2203	C. Jefferies	1	BF	26/05/76										5.9	151						0.15	
"	"	"	"	14/06/76											30				N.D.			518
"	"	"	"	22/06/76		2.2	0.06		0.01													

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
2203	C. Jefferies	1	BF	30/09/76	ppm	384	342	750	7.32	30	12	104	29.8	15.0	1.1	18.5	47	416.97	0.035	0.330	0.007	4.8	0.014	0.002	1	2.40
					epm							5.190	2.451	0.653	0.028	0.522	0.979	6.834				0.343				
					%epm							62.36	29.45	7.85	0.34	6.25	11.75	81.99								
"	"	"	"	28/11/76	ppm	396	335	760	7.39	5	5.3	103	27.8	14.1	1.3	23.5	54	408.44	0.015	0.285	0.004	0.55	0.008	0.001	1	0.94
					epm							5.140	2.287	0.613	0.033	0.663	1.124	6.694				0.039				
					%epm							63.67	28.33	7.59	0.41	7.82	13.25	78.93								
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2211	L. Heaslip	1	BF	08/06/76	ppm	400	367	780	7.65			95.0	34.0	18.8	1.2	23.5	29.0	447.45	0.08	0.705	0.011	0.04			2	6.8
					epm							4.741	2.797	0.818	0.031	0.663	0.604	7.334								
					%epm							56.53	33.35	9.75	0.37	7.71	7.02	85.27								
"	"	"	"	15/06/76	ppm	420	356	760	7.39							22.0	30.5								1	3.50
					epm																					
					%epm																					
"	"	"	"	22/06/76	ppm																					
					epm																					
					%epm																					
"	"	"	"	04/10/76	ppm	352	303	660	7.51	20	5.6	80.0	31.8	15.9	1.1	14.0	45.0	369.42	0.295	0.495	0.001	0.08	0.015	0.003	<1	1.0
					epm							3.992	2.615	0.692	0.028	0.395	0.937	6.058								
					%epm							54.48	35.69	9.44	0.38	5.35	12.68	81.97								

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand ; 5-Day	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic Detergent A.B.S.	Total Dissolved Solids
2203	C. Jefferies	1	BF	30/09/76											15	96	8	104		0		462
"	"	"	"	23/11/76									<0.02									
2211	L. Heaslip	1	BF	08/06/76										7.2	22							424
"	"	"	"	15/06/76									<0.02		18	95	5	100	N.D.			462
"	"	"	"	22/06/76		0.19	<0.01		<0.01													
"	"	"	"	04/10/76											<2.0	82	4	86		0		366

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
2211	L. Heaslip	1	BF	15/11/76	ppm	292	292		7.43					16.4	1.1	13.0	39.0								<1.0	1.00
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
15	J.N. Featherstone	1	BF	15/06/76	ppm	360	296	650	7.44							9.0	46								<1	2.4
					epm																					
					%epm																					
"	"	"	"	23/06/76	ppm																					
					epm																					
					%epm																					
"	"	"	"	04/10/76	ppm	340	297	670	7.75	5	3.1	94.5	26.8	10.0	0.9	12.5	53	362.11	0.025	0.195	0.003	0.64	0.021	0.009	1	0.88
					epm							4.716	2.205	0.435	0.023	0.353	1.103	5.935				0.046				
					%epm							63.91	29.88	5.90	0.31	4.78	14.92	80.30								
"	"	"	"	15/11/76	ppm	226	290		7.33					10.7	1.0	12.0	52								1	1.10
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

108

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic Detergent A.B.S.	Total Dissolved Solids
2211	L. Heaslip	1	BF	15/11/76											<1.9							
15	J.N. Featherstone	1	BF	15/06/76									<0.02		14	70	1	71	N.D.			430
"	"	"	"	23/06/76		0.48	<0.01		<0.01													
"	"	"	"	04/10/76											3.9	80	6	86		0		368
"	"	"	"	15/11/76											7.7							

[1] Location is shown in Figure 1 ; N.D. – Not detected; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2201	G.A. Fraser	1	BF	26/05/76	ppm	324	276	600	7.67							4.5	50		<0.005	0.180	0.024	1.05	0.008		<1	0.03
					epm																					
					%epm																					
"	"	"	"	14/06/76	ppm	344	268	600	7.56					4.6	0.6	3.5	46								<1	0.17
					epm																					
					%epm																					
"	"	"	"	22/06/76	ppm																					
					epm																					
					%epm																					
"	"	"	"	15/11/76	ppm	248	275	600	7.50	<5	0.25	70.5	22.4	4.8	0.7	3.5	51	335.28	0.005	0.10	<0.001	0.93	0.001	<0.001	1	<0.01
					epm							3.518	1.843	0.209	0.018	0.099	1.062	5.495				0.066				
					%epm							62.96	32.98	3.74	0.32	1.49	15.96	82.56								
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand ; 5-Day	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2201	G.A. Fraser	1	BF	26/05/76										0.3	<2.0						<0.1	
"	"	"	"	14/06/76											8				N.D.			384
"	"	"	"	22/06/76		0.20	<0.01		0.02													
"	"	"	"	15/11/76												68	8	76				

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
16	R. Gunn	1	BF	14/06/76	ppm	348	273	600	7.53					3.0	0.8	3.5	49.0									<1	0.24
					epm																						
					%epm																						
"	"	"	"	22/06/76	ppm																						
					epm																						
					%epm																						
"	"	"	"	15/11/76	ppm	340	285		7.40					7.5	0.9	8.5	57									<1	0.08
					epm																						
					%epm																						
					ppm																						
					epm																						
					%epm																						
					ppm																						
					epm																						
					%epm																						
					ppm																						
					epm																						
					%epm																						
2277	P. Knopp	1	BF	14/12/76	ppm	342	286		7.4			98	23	6	0.9	8	43	348.70	0.1	0.18	0.001	2.4			2	0.15
					epm							4.890	1.892	0.261	0.023	0.226	0.895	5.715				0.171					
					%epm							69.20	26.78	3.69	0.33	3.31	13.09	83.6									
"	J. Streefkerk	"	"	14/06/76	ppm	360	299	660	7.45					6.7	1.0	8.0	42									<1	0.05
					epm																						
					%epm																						
"	"	"	"	22/06/76	ppm																						
					epm																						
					%epm																						

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
16	R. Gunn	1	B.F.	14/06/76											6				N.D.			386
"	"	"	"	22/06/76		0.48	0.01		<0.01													
"	"	"	"	15/11/76											5.7							
2277	P. knopp	1	B.F	14/12/70																	0.1	
"	J. Streefkerk	"	"	14/06/76											9				N.D.			412
"	"	"	"	22/06/76		0.07	0.07		<0.01													

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Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2220	Wm. Hartley	1	B.F.	14/06/76	ppm	356	287	620	7.59					6.3	0.9	4.0	34								<1	0.03
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2213	S. Bruce	2	B.F.	14/06/76	ppm	364	302	675	7.54					7.7	1.8	9.0	42								1	0.07
					epm																					
					%epm																					
"	"	"	"	22/06/76	ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2217	R. Kenny	2	B.F.	14/06/76	ppm	324	269	600	7.32					4.1	4.6	7.0	30.0								1	0.12
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2220	Wm. Hartley	1	BF	14/06/76											2				N.D.			398
2213	S. Bruce	2	BF	14/06/76											6				N.D.			444
"	"	"	"	22/06/76		4.9	0.02		0.03													
2217	R. Kenny	2	BF	14/06/76											2	68	2	70	N.D.			384

[1]Location is shown in Figure 1 ; N.D. – Not detected; < -Refers to less than; 1 ppm=1 mg/l=1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVAST! AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm - 25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Fe Iron
2217	R. Kenny	2	BF	22/06/76	ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
17	J. Watling	2	BF	22/06/76	ppm	270	248	510	7.56					4.6	0.4	1.5	30.0								<1	0.04
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
18	J. Stansfield	2	BF	22/06/76	ppm	176	233	433	7.6					31.4	0.9	1.0	1.0								<1	0.99
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
2221 2214	DORLAND SUBDIVISION A. Wright	2	BF	15/06/76	ppm	278	259	540	7.5							4.0	31.0								<1	0.09
					epm																					
					%epm																					
11	DORLAND SUBDIVISION R. Ellis	11	11	22/06/76	ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
2217	R. KENNY	2	BF	22/06/76		1.3	0.02		<0.01													
17	J. Watling	2	BF	22/06/76		0.42	<0.01		<0.01				<0.02		5.8	66	2	68	N.D.			286
18	J. Stansfield	2	BF	22/06/76		0.10	<0.01		<0.01				<0.02		9.7	58	4	62	N.D.			248
2221 2214	DORLAND SUBDIVISION A. Wright	2	BF	15/06/76									<0.02		6	66	1	67	N.D.			324
"	DORLAND SUBDIVISION R. Ellis	"	"	22/06/76		0.33	0.01		<0.01													

[1] Location is shown in Figure 1 ; N.D. – Not detected; < – Refers to less than; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD | Township: SOUTH-WEST OXFORD | Date compiled: 16/12/76 | Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Iron Fe
3092	D. Karn	2	BF	15/11/76	ppm	252	246	520	7.56	20	8.1	61.5	25.4	10.7	0.9	4.0	34.5	299.93	0.155	0.295	<0.001	<0.01	0.004	<0.001		0.66
					epm							3.069	2.089	0.465	0.023	0.113	0.718	4.916								
					%epm							54.36	37.00	8.24	0.41	1.97	12.49	85.54								
"	"	"	"	23/11/76	ppm																				<1	
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
4002	H. Karn	1	I	15/11/76	ppm	224	248	478	7.62	100	20	50.5	21.8	19.0	1.0	2.5	20.0	302.37	0.215	0.395	0.001	<0.01	0.026	0.004		3.0
					epm							2.520	1.793	0.827	0.026	0.071	0.416	4.956								
					%epm							48.78	34.71	16.01	0.50	1.29	7.64	91.05								
"	"	"	"	23/11/76	ppm																				<1	
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					

[1] Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF WATER (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
3092	D. Karn	2	BF	15/11/76												60	6	66				
"	"	"	"	23/11/76																		
4002	H. Karn	1	I	15/11/76												59	7	66				
"	"	1	I	23/11/76																		

[1] Location is shown in Figure 1 ; N.D. – Not detected; < -Refers to less than; 1 ppm=1 mg/l=1 lb/100,000 Imp. gal.

APPENDIX C

SUMMARY OF CHEMICAL ANALYSES OF THE LANDFILL LEACHATE AND SOIL

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSIS OF LEACHATE

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD Township: SOUTH-WEST OXFORD Date compiled: 16/12/76 Compiler: T. ERVASTI and C. Riediger

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Iron Fe
1L	Denby Collection Basin	1	BF	15/06/76	ppm	1370	1351	3460	7.04							182	31								1500	128
					epm																					
					%epm																					
"	"	"	"	21/06/76	ppm																					
					epm																					
					%epm																					
1L(a)	"	"	"	04/11/76	ppm		2545	4350	7.22		1600	730	147	325	175	340	27	3102	113	130	0.04	<0.1	2.50	<0.05	1460	195
					epm							36.427	12.092	14.138	4.475	9.591	0.562	50.842								
					%epm							54.26	18.01	21.06	6.67	15.72	0.92	83.35								
1L(b)	"	"	"	23/11/76	ppm	940	1586	4010	7.58		250	188	121	375	200	365	33	1933.6	136	140	0.02	<0.1	0.50	0.15	850	31.5
					epm							9.381	9.953	16.312	5.114	10.297	0.687	31.692								
					%epm							23.02	24.42	40.02	12.55	24.13	1.61	74.26								
					ppm																					
					epm																					
					%epm																					
					ppm																					
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					%epm																					
					ppm																					
					epm																					
					%epm																					

[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSIS OF LEACHATE (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
1L	Denby Collector Basin	1	B.F.	15/06/76									<0.02		4474	1240	200	1440	N.D.			3438
〃	〃	〃	〃	21/06/76		0.18	0.04		0.11				<0.02									
1L(a)	〃	〃	〃	04/11/76									<0.02									

[1] Location is shown in Figure 1 ; N.D. – Not detected; < – Refers to less than; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSIS OF LEACHATE (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	pp'DDE	Polychlorinated Biphenyls	Suspended Solids	Sulphide H_2S	Triazines (p.p.b.)						Carbamates (ppb)		Total Dissolved Solids
														Prometone	Atrazine	Simazine	Cyprazine	De-ethyl. Atrazine	Metribuzin	Thio Carbamates	N-methyl Carbamates	
1L(b)	Denby Collector Basin	1	B.F.	23/11/76						0.003	0.25		<0.02	N.D. (<0.1)	1.0	trace (<0.1)	N.D.	trace	N.D.	EPTC 60	N.D. (<1.0)	

[1]Location is shown in Figure 1 ; N.D. – Not detected; < -Refers to less than; 1 ppm=1 mg/l=1 lb/100,000 Imp. gal.

Ministry of the Environment

Ontario

SUMMARY OF THE CHEMICAL ANALYSIS OF LEACHATE

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD   Township: SOUTH-WEST OXFORD   Date compiled: 16/12/76   Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Iron Fe
2L	Denby at N.W. corner	1	BF	15/06/76	ppm	412	344	720	7.45							3.5	54								2	1.34
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
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[1]Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSIS OF LEACHATE

Results reported in mg/l unless otherwise indicated (cont'd)

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic Detergent A.B.S.	Total Dissolved Solids
2L	Denby at N.W. corner	1	B.F.	15/06/76									<0.02		12	88	6	94	N.D.			442

[1] Location is shown in Figure 1 ; N.D. – Not detected; < -Refers to less than ; 1 ppm=1 mg/l=1 lb/100,000 Imp. gal.

Ministry of the Environment

Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF SOIL

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

All analyses except pH reported in mg/l unless otherwise indicated

County: OXFORD   Township: SOUTH-WEST OXFORD   Date compiled: 16/12/76   Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Units	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Conductance micromhos/cm-25°C	pH at lab	Apparent Color in Hazen Units	Turbidity in Formazin Units	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Chloride Cl	Sulphate SO_4	Bicarbonate HCO_3	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Total	Phosphorus as P: Soluble	Phenols (ppb)	Iron Fe
1S	J. Denby Well pit	1	BF	30/09/76	ppm									69		277									970	28573
					epm																					
					%epm																					
"	"	"	"	23/11/76	ppm	2540	210							140	270	20	2700								4	
					epm																					
					%epm																					
					ppm																					
					epm																					
					%epm																					
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[1] Location is shown in Figure 1 ; N.D. – Not detected ; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

Ministry of the Environment
Ontario

SUMMARY OF THE CHEMICAL ANALYSES OF SOIL (cont'd)

Results reported in mg/l unless otherwise indicated

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6E 1V3

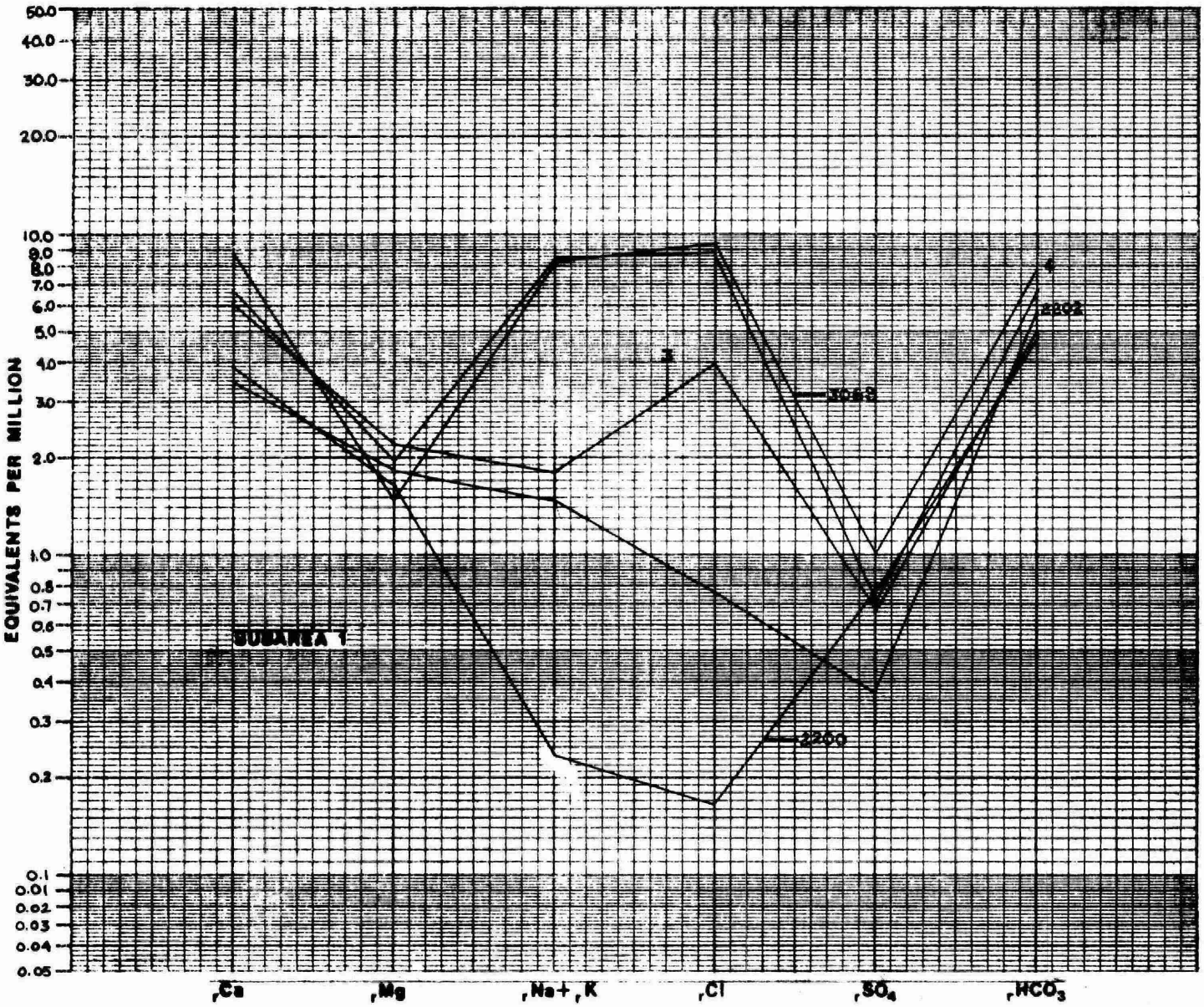
County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 16/12/76 Compiler: T. ERVASTI AND C. RIEDIGER

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Lead Pb	Zinc Zn	Copper Cu	Manganese Mn	Chromium Cr	Nickel Ni	Cadmium Cd	Suspended Solids	Sulphide H_2S	Biological Oxygen Demand	Chemical Oxygen Demand	Inorganic Carbon	Total Organic Carbon	Total Carbon	Petroleum Hydrocarbons	Tannins and Lignins	Anionic A.B.S. Detergent	Total Dissolved Solids
1S	J. Denby Well Pit	1	B.F.	30/09/76																		
"	"	"	"	23/11/76																0		

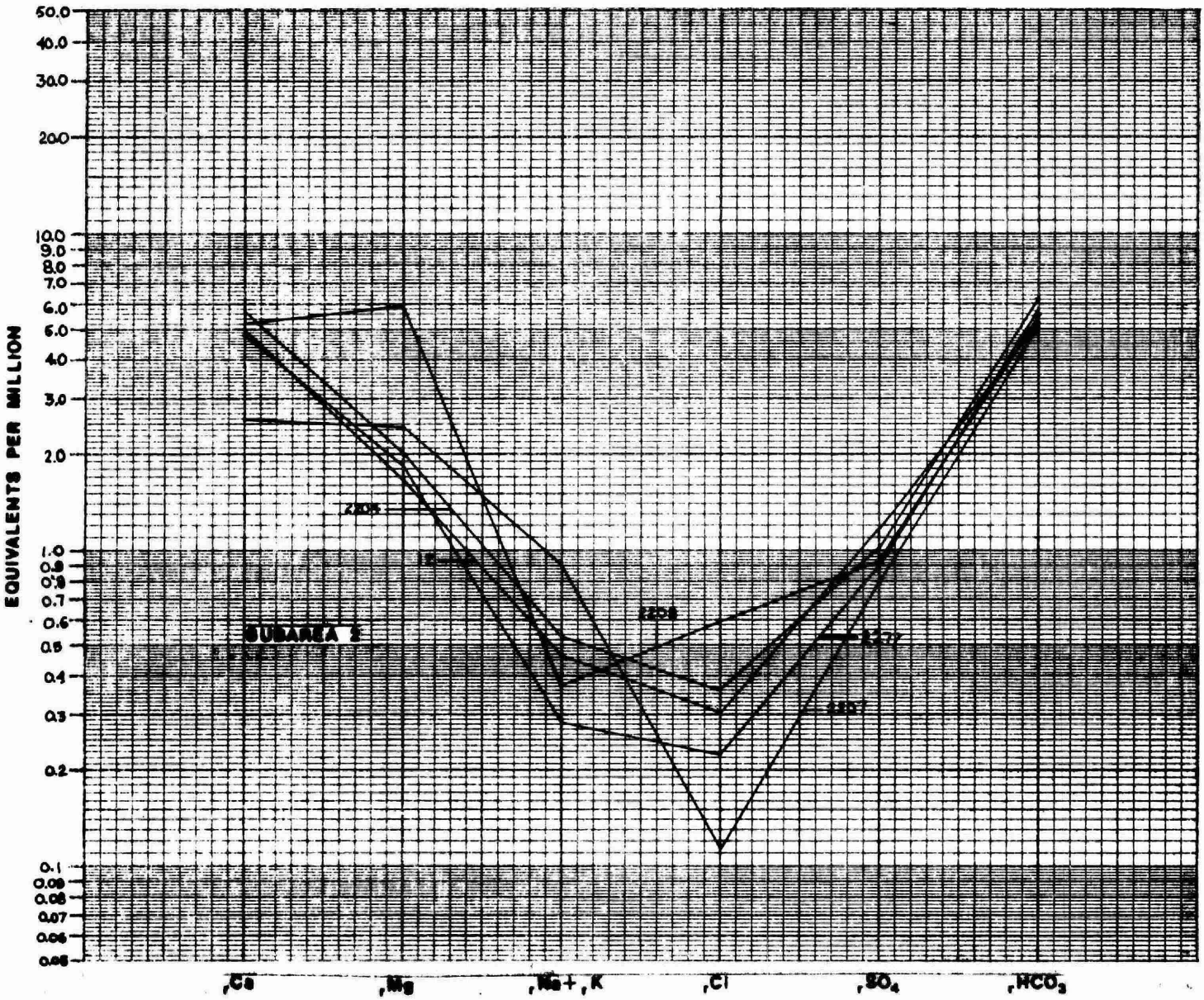
[1] Location is shown in Figure 1 ; N.D. – Not detected; < – Refers to less than ; 1 ppm = 1 mg/l = 1 lb/100,000 Imp. gal.

APPENDIX D

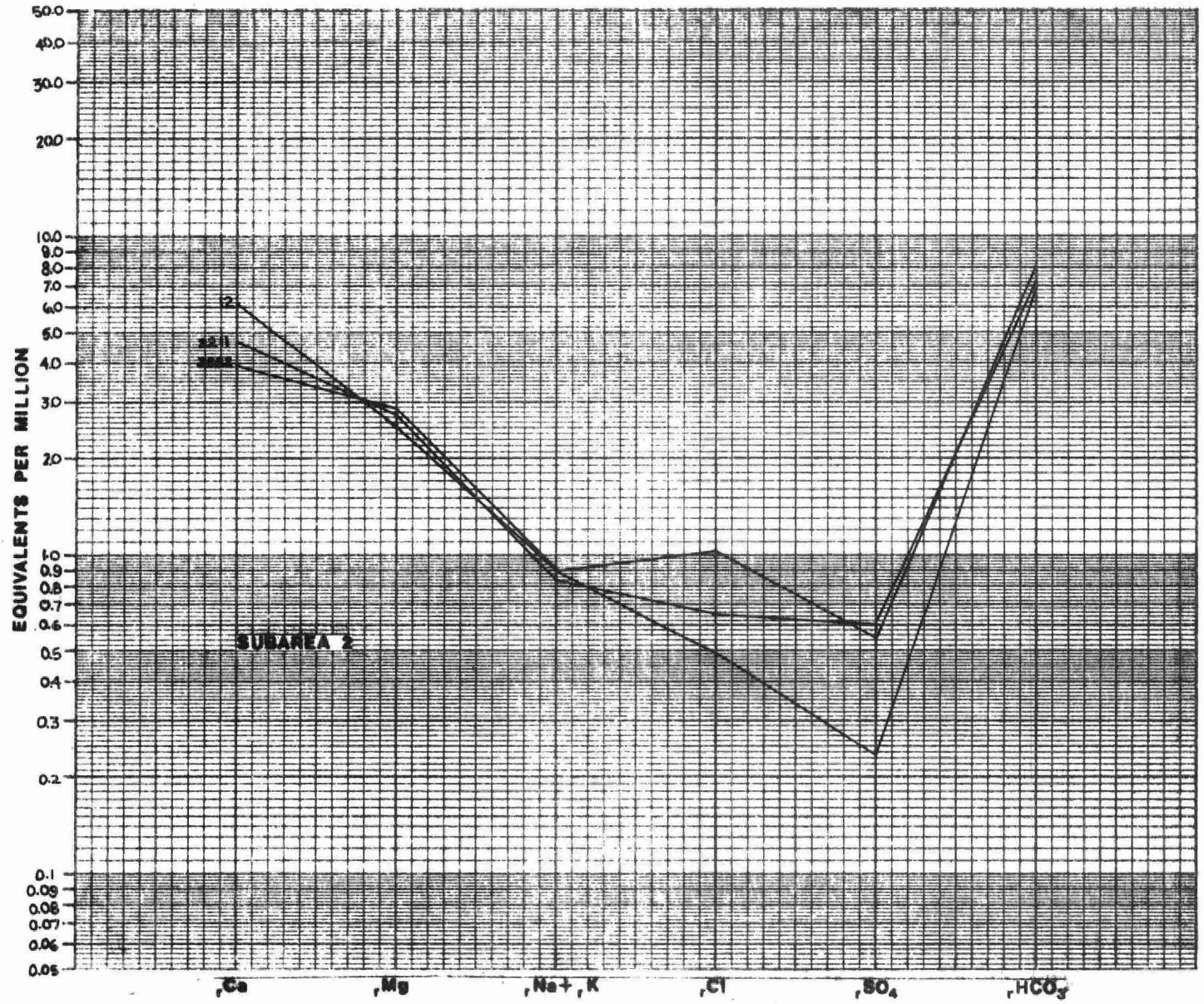
SEMI-LOGARITHMIC DIAGRAMS OF CHEMICAL ANALYSES FROM THE BEDROCK AQUIFER



DATE SAMPLED: July, September, or December, 1970



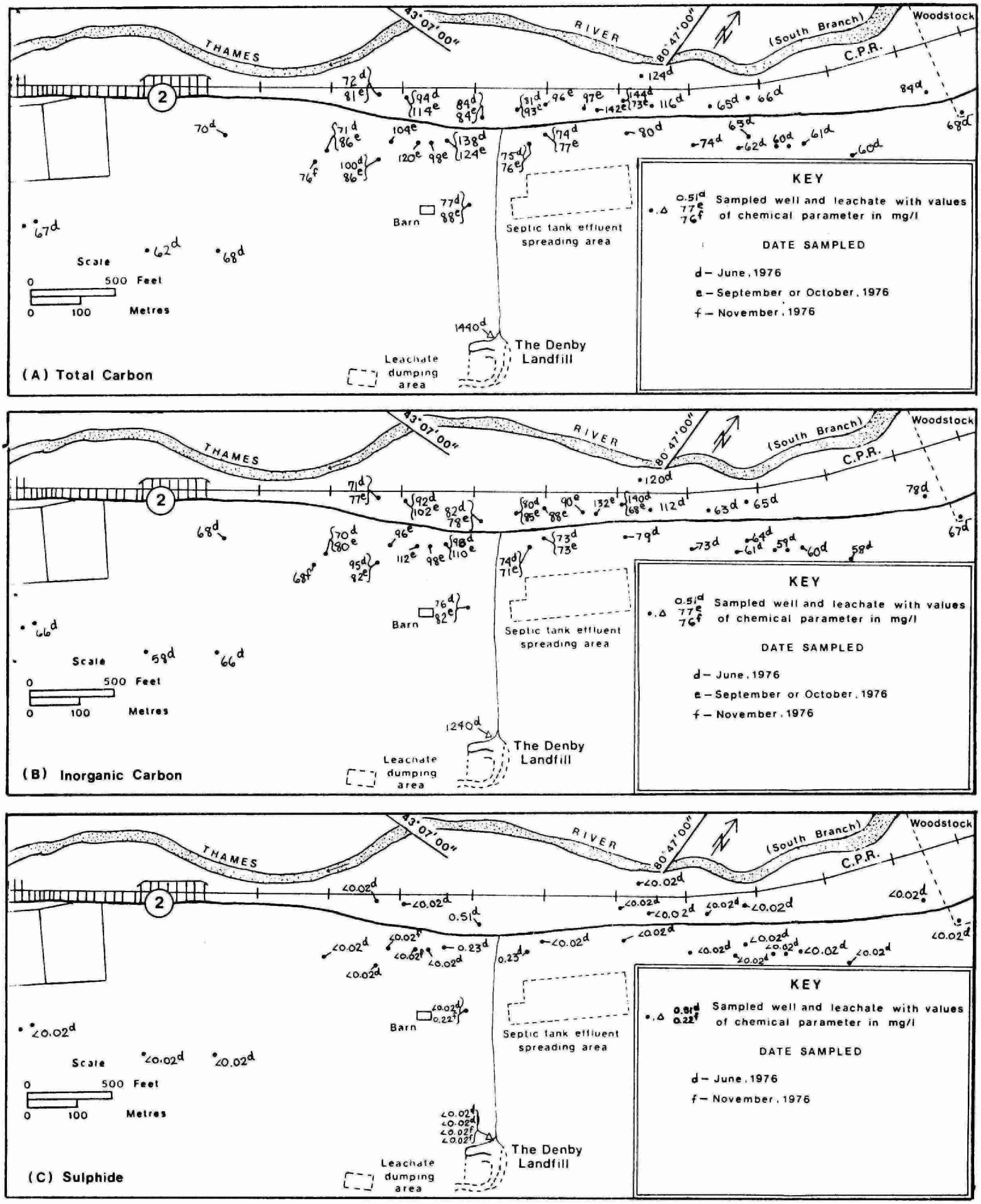
DATE SAMPLED: September or December, 1970



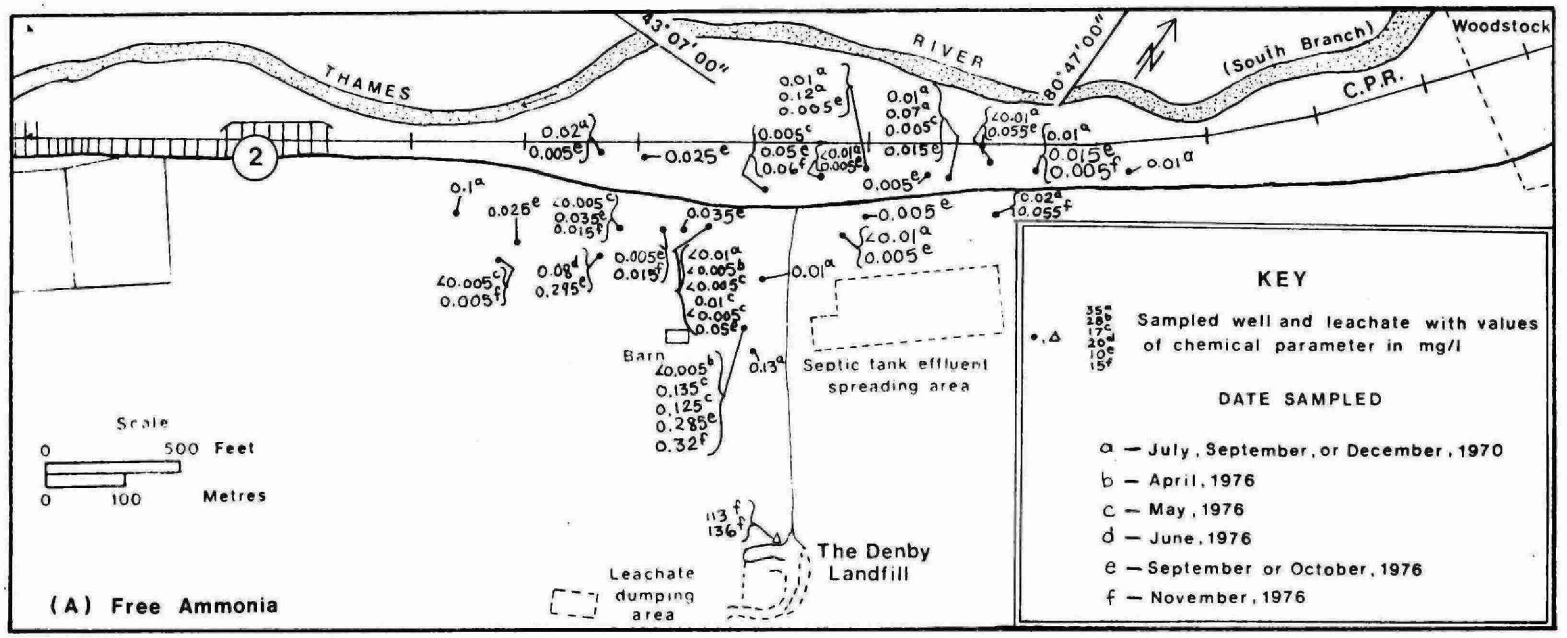
DATE SAMPLED: April or June, 1978

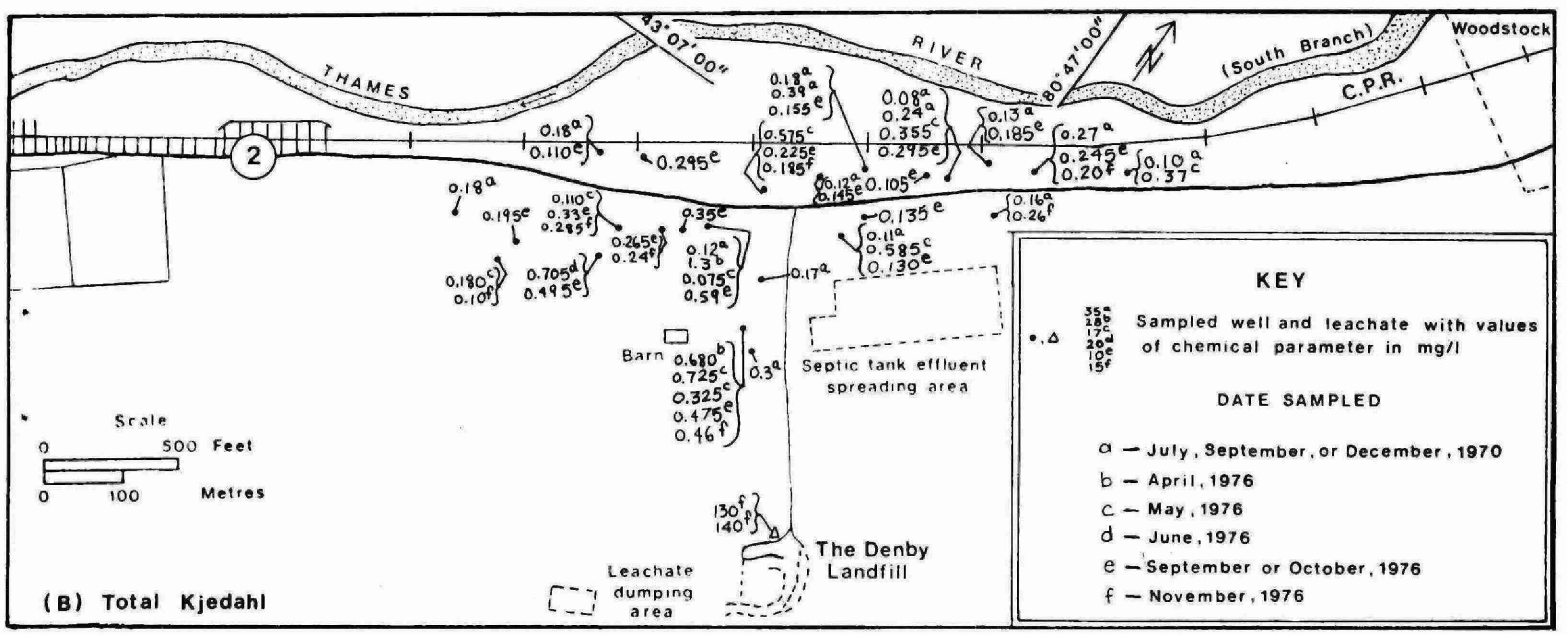
APPENDIX E

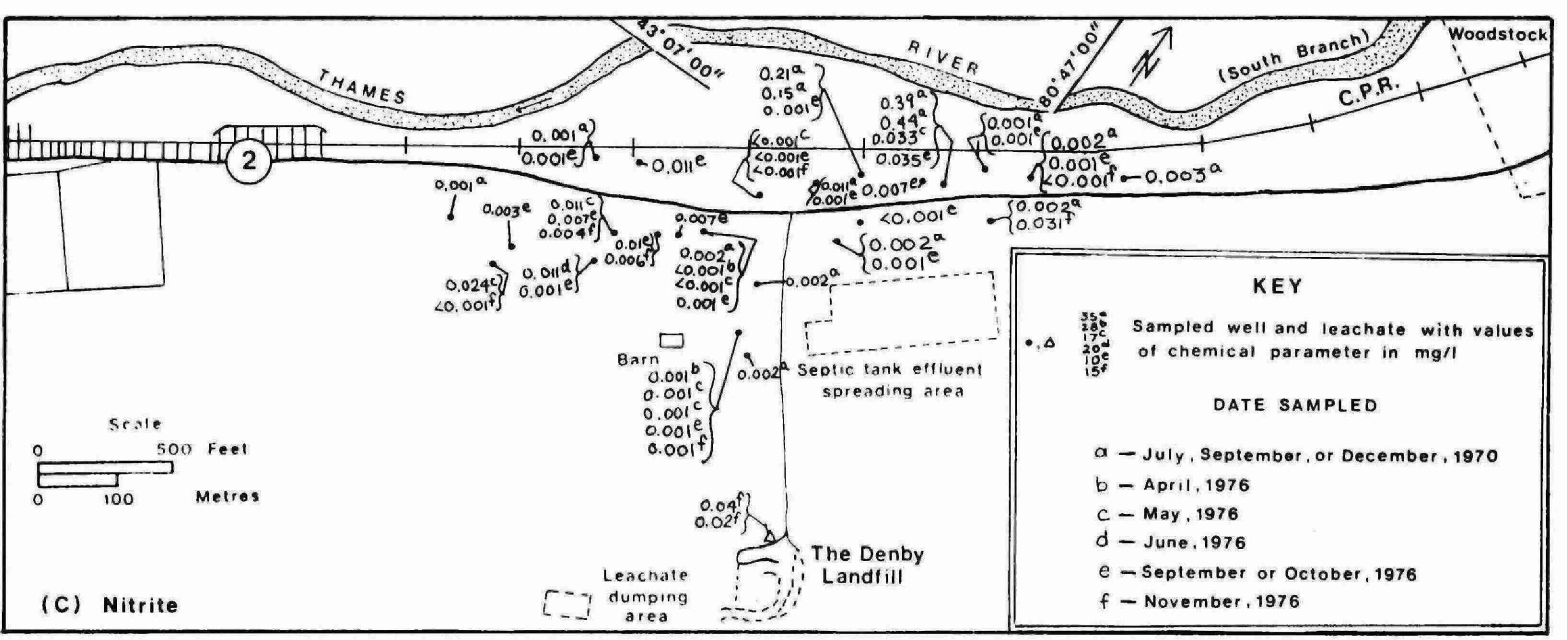
HYDROGEOCHEMICAL MAPS OF CHEMICAL CONSTITUENTS DISTRIBUTION IN THE BEDROCK AQUIFER



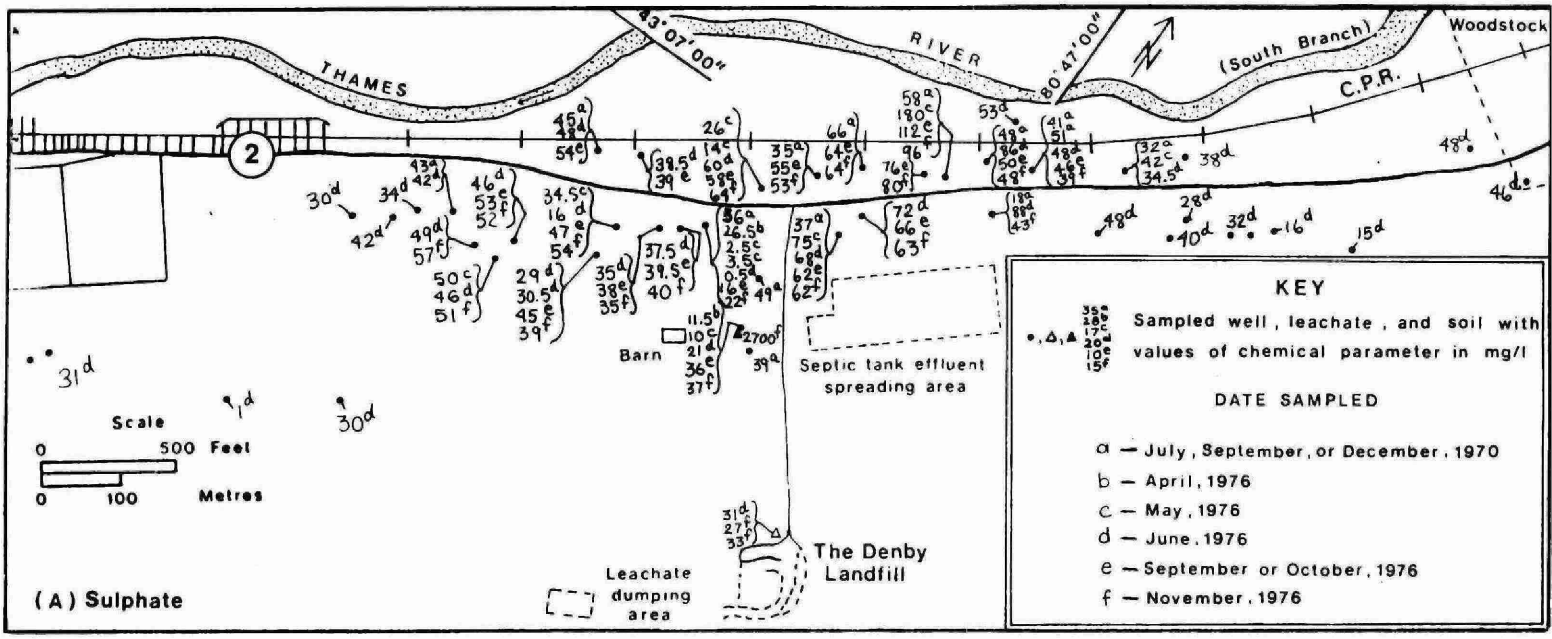
HYDROGEOCHEMICAL MAP OF TOTAL CARBON (A), INORGANIC CARBON (B) AND SULPHIDE (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN LANDFILL LEACHATE.

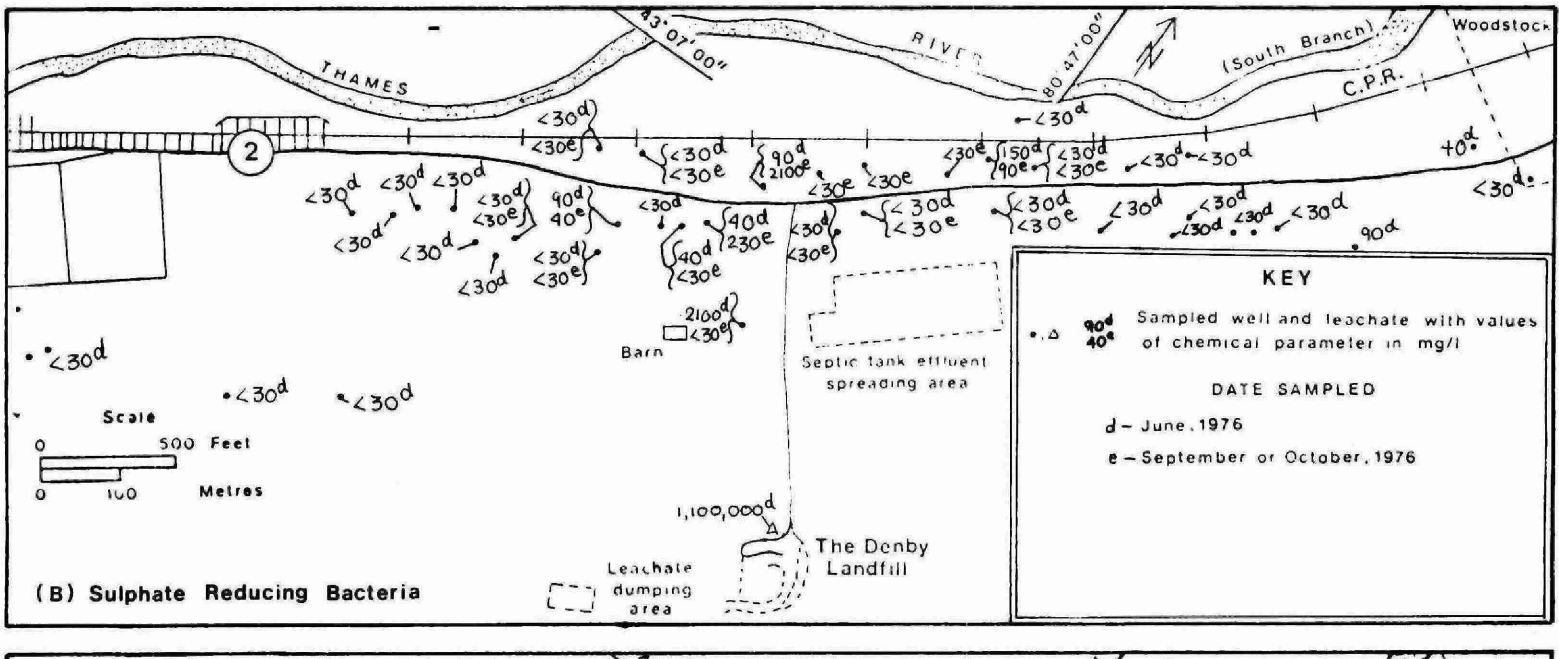


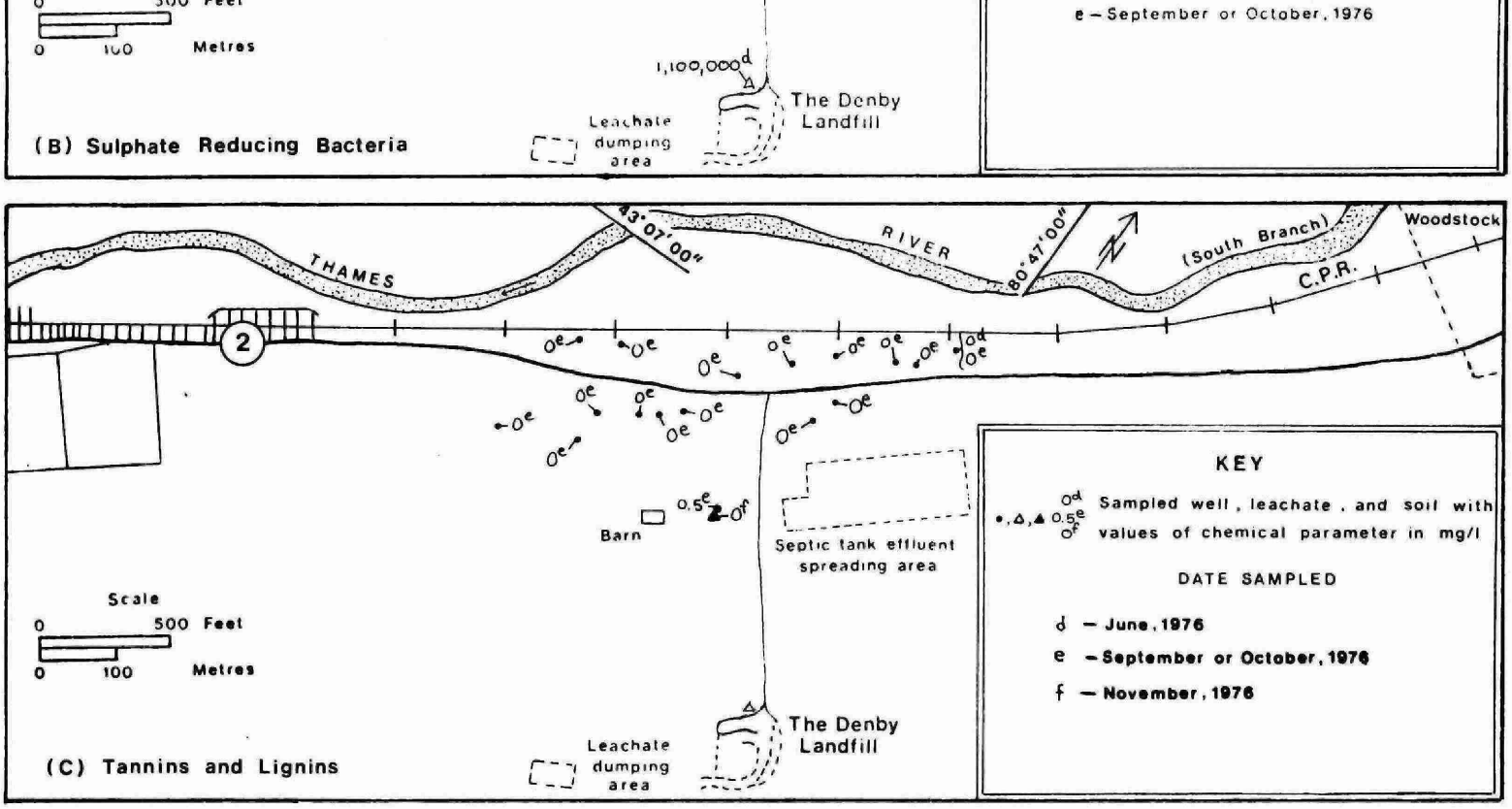




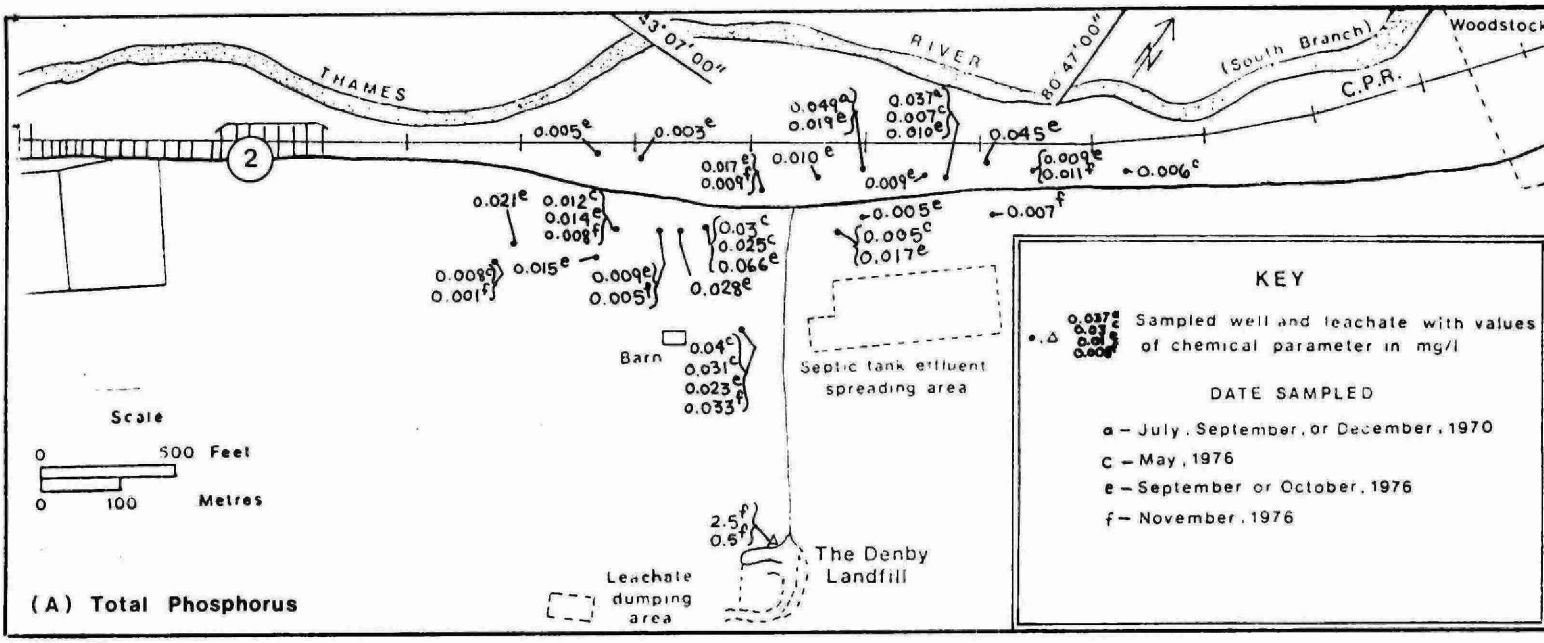
HYDROGEOCHEMICAL MAP OF FREE AMMONIA (A), TOTAL KJELDAHL (B) AND NITRITE (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN LANDFILL LEACHATE.

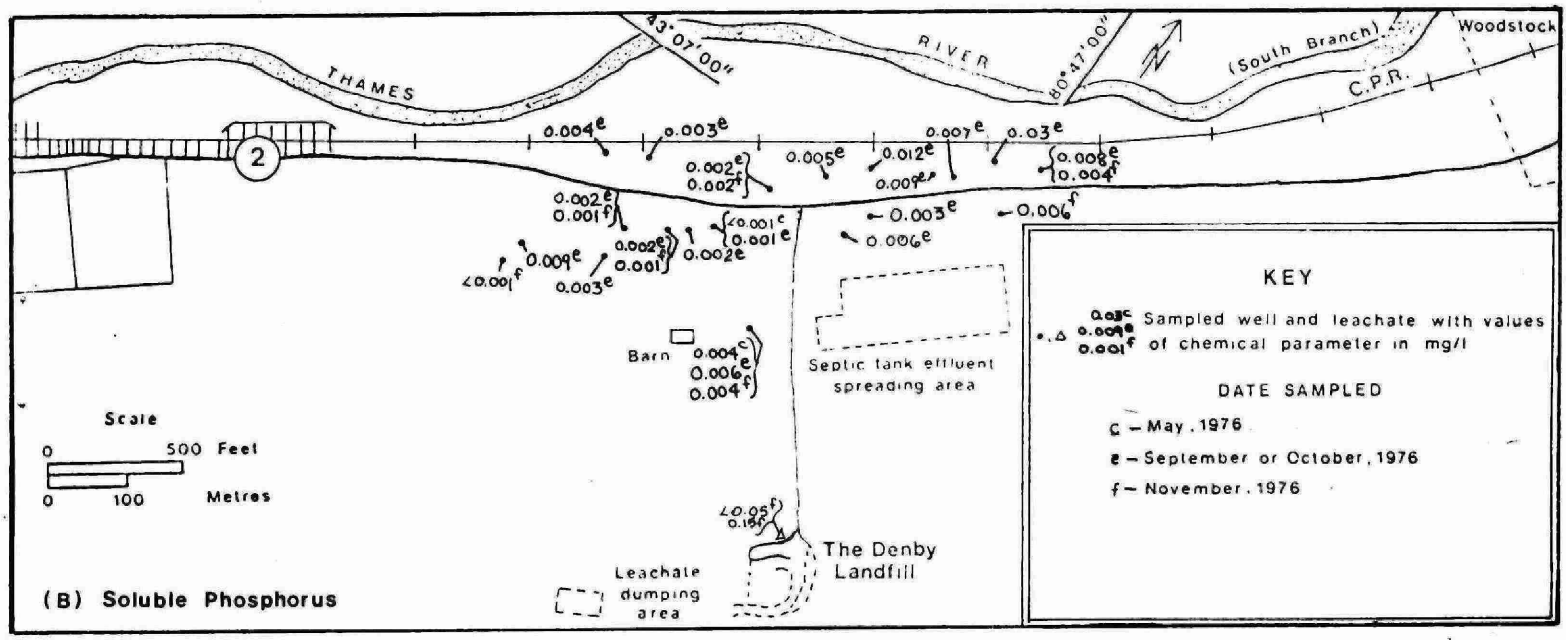


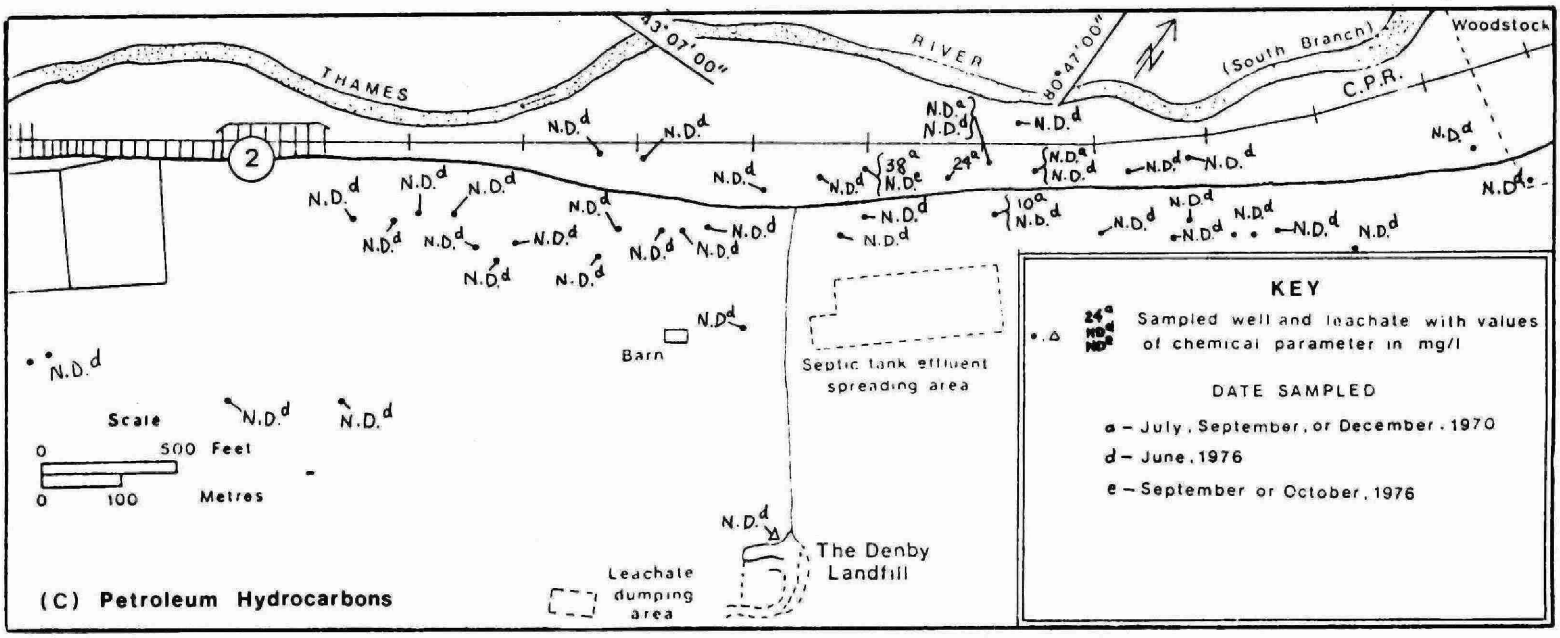




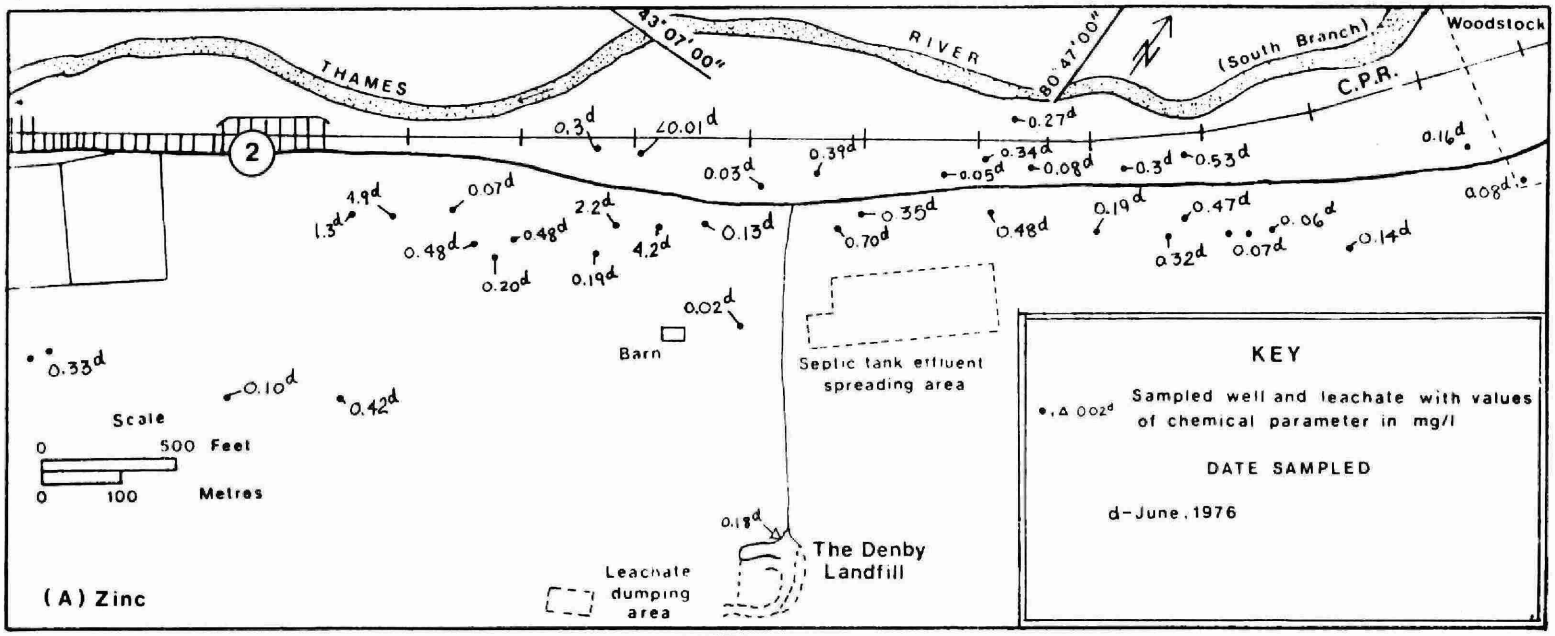
HYDROGEOCHEMICAL MAP OF SULPHATE (A), SULPHATE REDUCING BACTERIA (B) AND TANNINS AND LIGNINS (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN LANDFILL LEACHATE.

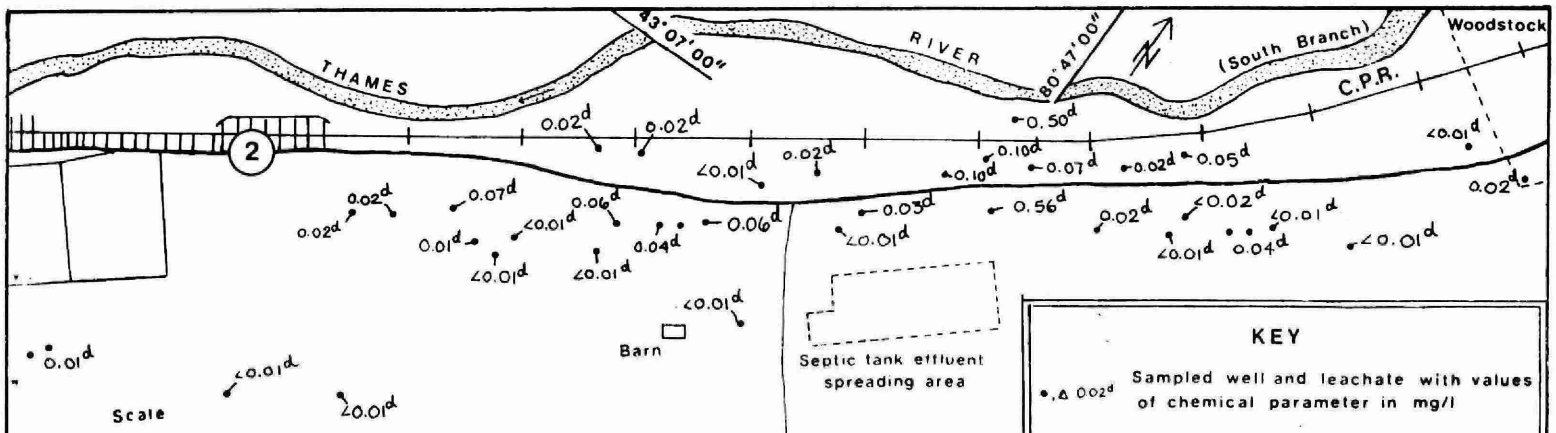


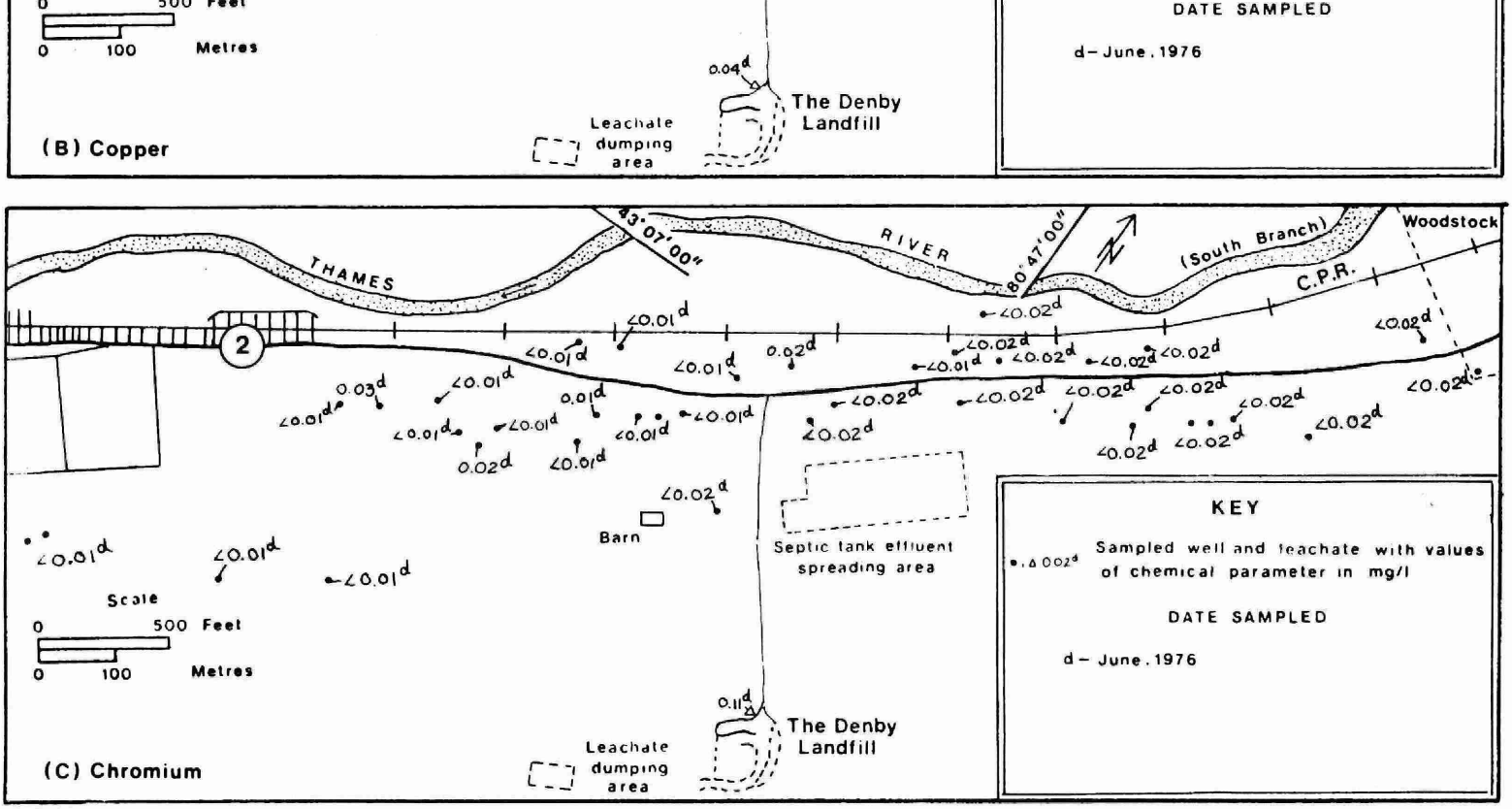




HYDROGEOCHEMICAL MAP OF TOTAL PHOSPHORUS (A), SOLUBLE PHOSPHORUS (B) AND PETROLEUM HYDROCARBONS (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN LANDFILL LEACHATE.







HYDROGEOCHEMICAL MAP OF ZINC (A), COPPER (B) AND CHROMIUM (C) DISTRIBUTION IN THE BEDROCK AQUIFER AND IN LANDFILL LEACHATE.

APPENDIX F

SUMMARY OF BACTERIOLOGICAL ANALYSES OF GROUNDWATER

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD **Township:** SOUTH-WEST OXFORD **Date Compiled:** 22/12/76 **Compiler:** T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
1	B. Crynen	Gore	BF.	21/06/76	0	1000	26	66		40
2	A. DeZutter	Gore	BF.	15/06/76	0	0	0	0		<30
3	D. Harburn	Gore	BF.	26/05/76	0	0	0	0		
"	"	"	"	15/06/76	0	0	0	0		<30

[1] Location is shown in Figure 1 ; <— Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD **Township:** SOUTH-WEST OXFORD **Date Compiled:** 22/12/76 **Compiler:** T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
4	G. Matern	Gore	B.F.	21/06/76	0	0	0	0		< 30
"	"	"	"	04/10/76						< 30
"	D. Harmer	Gore	B.F.	23/11/76	< 2	< 2	< 2	< 2		
2276	A. Radford	Gore	B.F.	21/06/76	0	0	0	0		< 30

[1] Location is shown in Figure 1 ; < – Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
2210	K. Lindsay	1	B.F.	21/06/76	>10,000	30	0			150
"	"	"	"	04/10/76						90
2879	D. Nancekivell	1	B.F.	30/09/70		8	2			
"	R. Millard	"	"	26/05/76	0	0	0	0		
"	"	"	"	04/10/76						<30

[1] Location is shown in Figure 1 ; < – Refers to less than; > – Refers to greater than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD **Township:** SOUTH-WEST OXFORD **Date Compiled:** 22/12/76 **Compiler:** T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
5	M.E. Elliot	1	B.F.	04/10/76						< 30
3069	F. Neill	1	B.F.	04/10/76						< 30
2280	Jim's Trailer Park	1	B.F.	21/05/76	0	0	0	0		
"	"	"	"	26/05/76	0	0	0	<4		
"	"	"	"	22/06/76	0	0	0	0		90

[1] Location is shown in Figure 1 ; <- Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
2280	Jim's Trailer Park	1	B.F.	04/10/76						2100
"	"	"	"	23/11/76	< 2	< 2	< 2	< 2		
2206	C. Gee	1	B.F.	22/06/76	0	0	0	0		< 30
"	"	"	"	04/10/76						< 30
2208	A.E. Slater	1	B.F.	22/06/76	0	0	0	0		< 30

[1] Location is shown in Figure 1 ; < — Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD **Township:** SOUTH-WEST OXFORD **Date Compiled:** 22/12/76 **Compiler:** T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
2208	A.E. Slater	1	B.F.	04/10/76						< 30
6	H. Robillard	Gore	B.F.	14/06/76	0	40	0	0		< 30
2275	Westmount motel N. DeLeon	Gore	B.F.	14/06/76	0	0	0	0		90

[1] Location is shown in Figure 1 ; < – Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD **Township:** SOUTH-WEST OXFORD **Date Compiled:** 22/12/76 **Compiler:** T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
7	J. Bowman	Gore	B.F.	22/06/76	0	0	0	0		<30
2278/3414	J. Radford	Gore	B.F.	14/06/76	0	0	0	0		<30
8	T. McGinnis	Gore	B.F.	21/06/76	0	42	0	0		<30

[1] Location is shown in Figure 1 ; <- Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD **Township:** SOUTH-WEST OXFORD **Date Compiled:** 22/12/76 **Compiler:** T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
9	F. Tilley	Gore	B.F.	14/06/76	0	0	0	0		<30
10	J. Hibner	Gore	B.F.	14/06/76	0	0	0	0		<30
2202	Con-Tario Precast Ltd.	1	B.F.	14/06/76	0	860	0	0		<30
"	"	"	"	04/10/76						<30
"	"	"	"	23/11/76	<2	1400	192	6		

[1] Location is shown in Figure 1 ; <- Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
11	G. Blais	1	B.F.	14/06/76	0	0	0	0		< 30
"	"	"	"	04/10/76						< 30
2200	A. Drysdale	1	B.F.	26/05/76	0	0	0	0		
"	"	"	"	15/06/76	0	0	0	0		< 30
"	"	"	"	04/10/76						< 30

[1] Location is shown in Figure 1 ; < – Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
3582	J. Denby	1	B.F.	21/04/76	0	0	0	0		
"	"	"	"	12/05/76	0	28	0	0		
"	"	"	"	26/05/76	0	12	0	0		
"	"	"	"	15/06/76	0	110	0	0		2100
"	"	"	"	04/10/76						<30
"	"	"	"	23/11/76	<2	4	<2	<2		

[1] Location is shown in Figure 1 ; <- Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD **Township:** SOUTH-WEST OXFORD **Date Compiled:** 22/12/76 **Compiler:** T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
12	K. Ellery	1	BF.	21/04/76	0	0	0	0		
"	"	"	"	12/05/76	<4	0	0	<4	0	
"	"	"	"	21/05/76	<4	<4	<4	<4		
"	"	"	"	26/05/76	0	0	0	0		
"	"	"	"	15/06/76	0	0	0	0		40
"	"	"	"	04/10/76						230

[1] Location is shown in Figure 1 ; <- Refers to less than

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Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD **Township:** SOUTH-WEST OXFORD **Date Compiled:** 22/12/76 **Compiler:** T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
13	E. Keatings	1	B.F.	14/06/76	0	4	0	0		40
"	"	"	"	04/10/76						<30
14	E. Seagrist	1	B.F.	14/06/76	0	0	0	0		<30
"	"	"	"	23/11/76	<2	<2	<2	<2		
2203	C. Jefferies	1	B.F.	26/05/76	0	32	0	0		

[1] Location is shown in Figure 1 ; <- Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
2203	C. Jefferies	1	B.F.	14/06/76	0	6	0	0		90
"	"	"	"	04/10/76						40
"	"	"	"	23/11/76	<2	<2	<2	<2		
2211	L. Heaslip	1	BF.	08/06/76	0	130	0	0	0	
"	"	"	"	15/06/76	<4	20	<4	<4		<30
"	"	"	"	04/10/76						<30

[1] Location is shown in Figure 1 ; <- Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
15	J.N. Featherstone	1	B.F.	15/06/76	<4	32	<4	<4		<30
"	"	"	"	04/10/76						<30
2201	G.A. Fraser	1	B.F.	26/05/76	0	0	0	0		
"	"	"	"	14/06/76	0	0	0	0		<30

[1] Location is shown in Figure 1 ; <- Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD **Township:** SOUTH-WEST OXFORD **Date Compiled:** 22/12/76 **Compiler:** T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
16	R. Gunn	1	B.F.	14/06/76	0	4	0	0		<30
2277	J. Streefkerk	1	B.F.	14/06/76	0	0	0	0		<30
2220	Wm. Hartley	1	B.F.	14/06/76	0	8	0	0		<30

[1] Location is shown in Figure 1 ; <— Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
2213	S. Bruce	2	B.F.	14/06/76	0	10	0	0		<30
2217	R. Kenny	2	B.F.	14/06/76	0	4	0	0		<30
17	J. Watling	2	B.F.	22/06/76	0	0	0	0		<30

[1] Location is shown in Figure 1 ; <- Refers to less than

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF WATER

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
18	J. Stansfield	2	B.F.	22/06/76	0	0	0	0		<30
2221	Dorland Subdivision A. Wright	2	B.F.	15/06/76	0	0	0	0		<30
4002	H. Karn	1	I	23/11/76	<2	<2	<2	<2		

[1] Location is shown in Figure 1 ; <— Refers to less than

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BACTERIOLOGICAL ANALYSES OF WATER

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Southwestern Region
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County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
3092	D. Karn	2	B.F.	23/11/76	<2	<2	<2	<2		

[1] Location is shown in Figure 1 ; <- Refers to less than

APPENDIX G

SUMMARY OF BACTERIOLOGICAL ANALYSES OF THE LANDFILL LEACHATE

Ministry of the Environment
Ontario

BACTERIOLOGICAL ANALYSES OF LEACHATE

Results per 100 mls.

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3

County: OXFORD Township: SOUTH-WEST OXFORD Date Compiled: 22/12/76 Compiler: T. ERVASTI

Identification Number[1]	Owner or Source	Lot	Concession	Date Sampled	Fecal Coliform	Background Colonies	Coliform Bacteria	Enterococcus	Pseudomonas Aeruginosa	Sulphate Reducers
1L	Denby Collector Basin	1	B.F.	15/06/76	190	>10,000	2100	200		1,100,000
"	"	"	"	23/11/76	140	45,000	4200	500	inconclusive result	
2L	Denby at N.W. corner	1	B.F.	15/06/76	1500	1,400,000	62,000	1200		< 30

[1] Location is shown in Figure 1 ; <- Refers to less than; >-Refers to greater than